Draft Environmental Assessment
for
Possible Management Actions to Save the Po`ouli

Maui County, Hawaii

State of Hawaii
Department of Land and Natural Resources

United States Department of the Interior
Fish and Wildlife Service

September 1998

DRAFT ENVIRONMENTAL ASSESSMENT

Possible Management Actions to
Save the Po`ouli
Melamprosops phaeosoma

U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Pacific Islands Ecoregion

Hawai`i Department of Land and
Natural Resources
Division of Forestry and Wildlife

Authorities for Action:
NATIONAL ENVIRONMENTAL POLICY ACT OF 1969
U.S. ENDANGERED SPECIES ACT OF 1973, as amended
HAWAI`I ENVIRONMENTAL IMPACT STATEMENT LAW (HRS Chapter 343)
HAWAI`I ENDANGERED SPECIES LAW (HRS 195D)

Prepared by:

Karen Rosa and Dave Hopper
U.S. Fish and Wildlife Service
Pacific Islands Fish and Wildlife Office
Pacific Islands Ecoregion
Honolulu, Hawai`i

Sharon Reilly, Wildlife Biologist
Hawai`i Department of Land and Natural Resources
Division of Forestry and Wildlife
Honolulu, Hawai`i

September 1998

Summary Information

Proposed Action:	Po`ouli (*Melamprosops phaeosoma*) Recovery Actions
Applicant:	Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) 1151 Punchbowl Street, Room 325 Honolulu, Hawaii 96813 United States Department of the Interior (USDI) U.S. Fish and Wildlife Service (USFWS) Pacific Islands Fish and Wildlife Office 300 Ala Moana Blvd., Room 3-122 Honolulu, Hawaii 96850
Location:	Hanawī Natural Area Reserve Hāna District, Maui, Hawaii
Determination:	Anticipated FONSI
Approving Agency:	DLNR-DOFAW and USDI-USFWS
Permits Required:	Federal Endangered Species Permit (Obtained) Possibly a Conservation District Use Permit

AGENCIES AND ORGANIZATIONS CONSULTED OR CONTACTED IN PREPARING THE DRAFT ENVIRONMENTAL ASSESSMENT

Federal:	U.S. Department of Agriculture U.S. Geological Survey, Biological Resources Division National Park Service, Haleakalā National Park National Zoological Park, Conservation and Research Center
State:	Hawai`i Division of Forestry and Wildlife, Maui District University of Hawai`i, Cooperative Parks Studies Unit
County:	None

Others: Kamehameha Schools/B.P. Bishop Estate
The Nature Conservancy of Hawaii
The Peregrine Fund
Bishop Museum
East Maui Watershed Partnership

Federal Recovery Teams:
Avian Disease Recovery Working Group
Captive Propagation Recovery Working Group
Hawaii Forest Bird Recovery Team
Pacific Avifauna Recovery Coordinating Committee

Executive Summary

The U.S. Fish and Wildlife Service (USFWS) and State of Hawai`i Department of Land and Natural Resources (DLNR) are considering emergency measures to prevent the extinction of the Po`ouli (*Melamprosops phaeosoma*), a native Hawaiian forest bird from Maui whose population may total only three birds. The USFWS and DLNR have prepared a Draft Environmental Assessment (DEA). It presents a historical review of the conservation efforts to protect the Po`ouli, examines a range of alternative management measures, analyzes ppossible environmental effects of the alternatives, and serves as the basis for a decision by the USFWS and DLNR on which alternative, if any, to implement.

All actions proposed in the DEA would take place in the Hanawī Natural Area Reserve (NAR), portions of Haleakalā National Park, and possibly the Maui Bird Conservation Center (MBCC) located at Olinda, Maui, the Keauhou Bird Conservation Center (KBCC) at Volcano, Hawai`i, or another approved captive propagation facility. The 3,035 hectare Hanawī NAR lies within the Ko`olau Forest Reserve in the Hāna District of Maui. All areas in the field are zoned conservation.

Summary of Proposed Alternatives

The recovery actions being presented in this DEA are intended to prevent the imminent extinction of the Po`ouli. The alternatives being proposed are summarized below.

ALTERNATIVE 1	CONTINUE CURRENT MANAGEMENT ACTIONS-NO MANIPULATION OF KNOWN INDIVIDUALS
ALTERNATIVE 2	TRANSLOCATION AND RELEASE OF AT LEAST ONE INDIVIDUAL TO INITIATE PAIR FORMATION
ALTERNATIVE 3	HOLD SHORT-TERM IN FIELD AVIARY FOR PAIR FORMATION AND THEN RELEASE PAIR BACK TO THE WILD
ALTERNATIVE 4	HOLD A PAIR LONG-TERM IN A FIELD AVIARY FOR PROPAGATION, COLLECT EGGS FOR REARING AND RELEASE
ALTERNATIVE 5	HOLD SHORT-TERM IN FIELD AVIARY THEN TRANSFER TO CAPTIVE PROPAGATION FACILITY
ALTERNATIVE 6	IMMEDIATELY BRING A PAIR OR ALL THREE BIRDS INTO CAPTIVE PROPAGATION FACILITY FOR CAPTIVE BREEDING

Agency Determination

At this time, the agencies do not have a preferred alternative. None of the alternatives being proposed are expected to cause significant, irreversible impacts to the environment, pursuant to the significance criteria established by the Environmental Council (Hawai`i Administrative Rules, Section 11-200-12); therefore, the anticipated determination is a Finding of No Significant Impact. (See attached summary of Significance Criteria.)

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1 Chapter 1. Need for and Purpose of the Action

1.1 Introduction

The U.S. Fish and Wildlife Service (USFWS) and State of Hawai`i, Division of Forestry and Wildlife (DOFAW), are considering emergency measures to prevent the extinction of the Po`ouli (*Melamprosops phaeosoma*), a native Hawaiian forest bird from the island of Maui, whose population may total only three (3) birds. This Draft Environmental Assessment (EA) was prepared by the USFWS and DOFAW. It presents a historical review of the conservation efforts to protect the Po`ouli, examines a range of alternative management measures, analyzes the possible environmental effects of the alternatives, and serves as the basis for a decision by the USFWS and DOFAW on which alternative, if any, to implement. At this time the agencies do not have a preferred alternative. This Draft EA also provides an opportunity for public involvement.

1.2 Background Information

The Po`ouli (*Melamprosops phaeosoma*) was first discovered by college students during the Hāna Rain Forest Project in 1973 in the upper elevation rainforest of East Maui at 1,980 meters (m) (6,494 feet (ft)) elevation. It was the first new Hawaiian bird species discovered since 1923,and the species was so unique that it was placed in a new monotypic genus, *Melamprosops.* It was given the common name of Po`ouli, which means “black-faced” in Hawaiian, by Mrs. Mary Kawena Pukui, a leading authority on the Hawaiian language (Casey and Jacobi 1974).

1.2.1 Po`ouli Population Range, Distribution, and Size

In recent years the Po`ouli’s range has been restricted to the northeast slope of Haleakalā Volcano, east of the west branch of Hanawī Stream to the headwaters of Heleleike`oha Stream, in an area of about 600 hectares (ha) (1,483 acres (ac)); however, subfossil records indicate that the Po`ouli once had a much wider distribution and inhabited the southwest slope of Haleakalā Volcano at 300-1,500 m (1,000-4,800 ft) elevation in much drier habitat (Pratt *et al.* 1997). All historic detections of Po`ouli have been within the Hanawī Natural Area Reserve (NAR), Hāna Forest Reserve, and Haleakalā National Park (HALE NP) (Pratt *et al.* 1997).

The Po`ouli population was initially estimated to be fewer than 200 birds (Casey and Jacobi 1974) and has experienced a precipitious decline since its discovery (Mountainspring *et al*. 1990, Reynolds and Snetsinger, in prep.). In 1975, the population density in the Hanawī NAR was estimated to be 76 birds per square kilometer (km^2); in 1981, the density was estimated at 15 birds/km^2; and, in 1985, was only 8 birds/km^2, representing a 90% decline in density from 1975 to 1985 (Mountainspring *et al.* 1990). Mountainspring *et al.* (1990) hypothesized a direct correlation between Po`ouli decline and increase in pig activity in the study area. From 1975 to 1985, when the Po`ouli population density within the Hanawī NAR declined by 90%, there was a concurrent 473% increase in pig activity, as indexed by ground cover disturbance (Mountainspring *et al.* 1990).

During the 1980s, the Po`ouli disappeared from the westernmost portion of its range, between the west and east branches of the Hanawī Stream, an area of about 50 ha (124 ac) (Pratt *et al.* 1997). It is now known only from the area east of the east branch of Hanawī Stream, to and including Lake Wai`ele`ele, in an area of about 121 ha (299 ac), between 1,418-2,037 m (4,650-6,680 ft) elevation.

1.2.2 Habitat Management and Restoration: A Historical Review

In 1986, the State of Hawai`i established the 3,035 ha (7,500 ac) Hanawī NAR in the Hāna District of Maui (Figure 1) to protect the watershed of East Maui, preserve nine native plant communities, provide habitat for the highest number and density of endangered forest birds in the State, and create a habitat link between the Haleakalā National Park on its south border and the Ko`olau Forest Reserve on its east and west borders (DLNR 1989). Following the establishment of Hanawī NAR, the Hawai`i Division of Forestry and Wildlife began to take steps to protect the forest from impacts of feral goats and pigs by fencing three large tracts within the reserve (Kūhiwa/Wai`ele`ele, Po`uli, and Pu`u `Alaea Units) and removing feral ungulates from within these units (Figure 2).

In addition, the East Maui Watershed Partnership, a historic partnership established in 1991 between the State of Hawai`i, the National Park Service, Maui County, The Nature Conservancy of Hawai`i (TNCH) and other private landowners, initiated management efforts to fence selected upper watershed areas in East Maui and control ungulates in critical areas. The complete fencing plan is detailed in the *Final Environmental Assessment For A Fence Project To Protect the East Maui Watershed* (1996).

Since fencing of Hanawī NAR began in February 1990, pigs have been steadily removed from within the three management units. Vegetation has begun to recover in the areas of pig removal, but not to density levels measured in 1973 (Casey, personal communication 1996). Fencing of the last of the three management units in the upper elevations of Hanawī NAR was completed by

Figure 1
Hanawi Natural Area Reserve (NAR)
Fenced and Unfenced Units

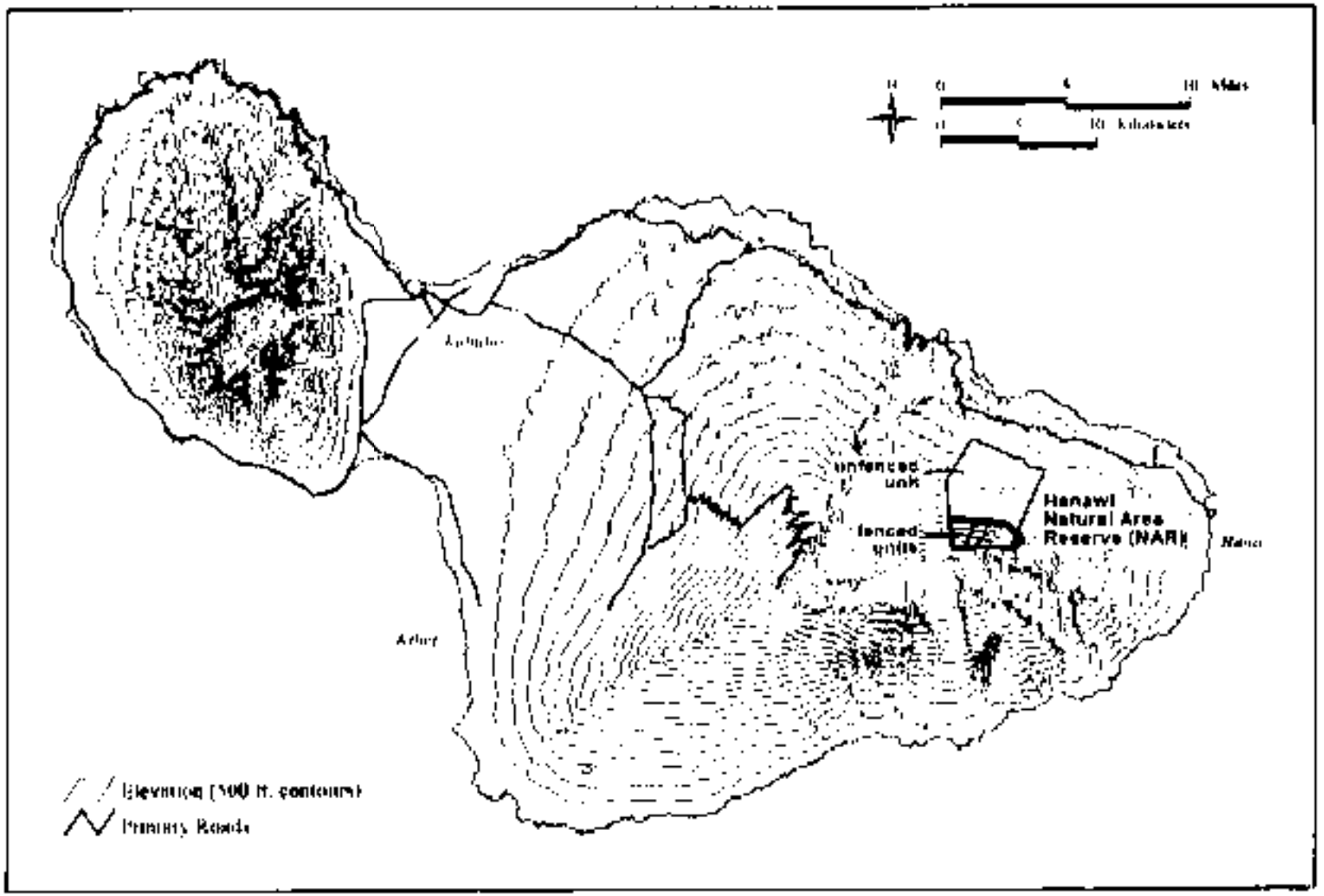
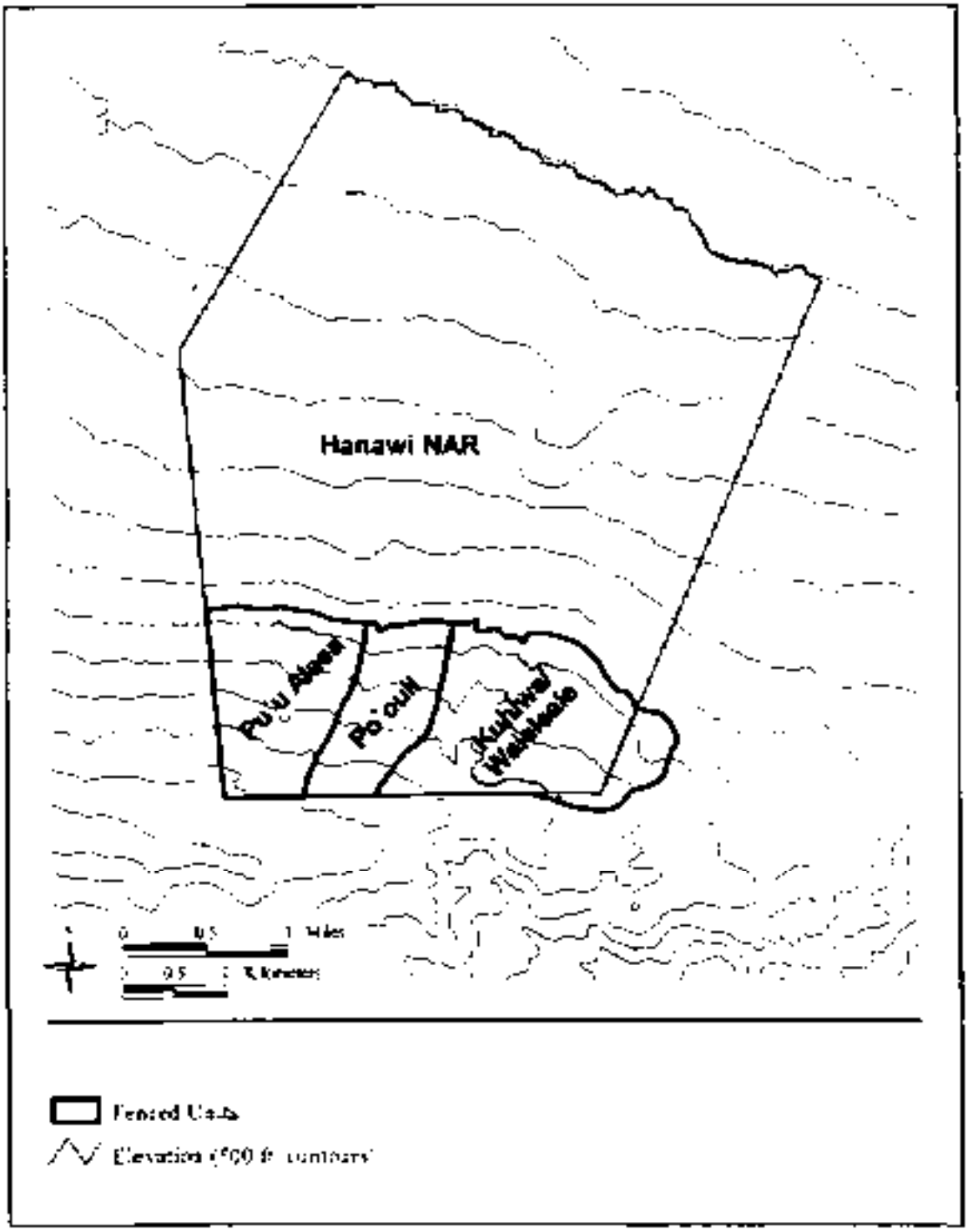


FIGURE 2
Hanawi NAR, showing the three fenced ungulate removal units: Pu'u Alaea, Po'ouli and Kuhiwa/Waiohuli



DOFAW in June 1996, and pig removal from these units was believed to be completed in late 1997. An estimated 200 pigs have been removed from these units since ungulate control began in 1990 (B. Evanson, DOFAW, personal communication 1998). However, Jennifer Turner and Torrie Haurez (DOFAW-NARS) conducted surveillance trips in February and May 1998 and documented recent pig intrusion in two of the three management units -- the 202-ha (500-ac) Pu`u `Alaea Unit and the 405-ha (1,000-ac) Kūhiwa/Wai `ele `ele Unit (Kūhiwa Unit). Only the 202-ha (500-ac) Po`ouli Unit is believed to be completely pig-free at the present time (B. Gagné and B. Evanson, DOFAW, personal communications 1998).

While fencing and ungulate removal actions have been underway, the Po`ouli and other native forest birds have continued to decline. Five species of endangered forest birds are known to have existed in the last ten years in Hanawī NAR, Haleakalā National Park, and surrounding forest. These included Maui Parrotbill (*Pseudonestor xanthophrys*), Maui `Ākepa (*Loxops coccineus ochraceus*), Maui Nukupu`u (*Hemignathus lucidus affinus*), `Ākohekohe or Crested Honeycreeper (*Palmeria dolei*), and Po`ouli. Despite the progress made in removing feral ungulates from the high elevation forests of East Maui, a preliminary analysis of bird surveys conducted in 1980 and 1992 in the Hanawī area indicates that populations of endangered birds declined over this time period (Paul Conry, DOFAW, personal communication 1997). The reasons for this decline are not thoroughly understood but are believed to be continued predation by introduced mammalian predators (i.e., 3 species of rats, mongooses and cats); avian disease; habitat degradation as a result of feral pig activity in the forest; competition with introduced birds; and possible lack of adequate food resources.

1.2.3 Po`ouli Breeding and Nesting Behavior

Only two Po`ouli nests have been documented and studied. In 1985-1986, USFWS biologist Cameron Kepler (now with U.S. Geological Service/Biological Resources Division (BRD)) and DOFAW biologist Andrew Engilis (now with Ducks Unlimited) conducted studies on endangered Maui birds, including the Po`ouli. In 1986, they discovered and monitored two active nests of a single pair of Po`ouli, located in a tributary ravine of the East Hanawī Stream at 1,800 m (5,900 ft) elevation (Kepler *et al*. 1996). Two chicks were hatched in the first nest in April, but they subsequently died in a downpour of 350 mm (14 in) rain during April 8-14. Following the failure of the first nest, the Po`ouli pair nested again within 30 m (98 ft) of their first nest. This second nest fledged one chick at the end of May 1986 (Kepler *et al*. 1996).

The last known breedings of Po`ouli occurred in 1994 and 1995, inferred by the sightings of a fledgling in August 1994 (BRD 1994a) and an immature bird in October 1996 (BRD 1996b).

1.2.4 Maui Forest Bird Project: Bird Monitoring Activities

During the Maui Forest Bird Survey of 1992, no Po`ouli were sighted. This prompted an

additional search to confirm the status of this species. In September 1993, Dr. Thane Pratt of the National Biological Survey (now BRD), Betsy Gagné of DOFAW-NARS, and Tonnie Casey (Kamehameha Schools/B.P. Bishop Estate (KSBE)), traveled to Hanawī NAR to search for Po`ouli. On September 12, 1993, while standing on the ridge at 1,799 m (5,900 ft) elevation where the Po`ouli nests were located in 1986, the group of searchers observed a single Po`ouli with a flock of Maui `Alauahio or Maui Creeper (*Paroreomyza montana*). The following day, Gagné observed a lone Po`ouli about 200-300 m (658-986 ft) from the 1986 nest site. It is unknown whether these sightings were of the same individual or of two different birds (Pratt, unpublished data 1993).

In May 1994, the USFWS entered into a cooperative recovery project with Department of Land and Natural Resources (DLNR) DOFAW, NBS (now BRD), and TNCH to conduct field studies of endangered forest birds on Maui. The three species targeted for this project were the Po`ouli, `Ākohekohe (*Palmeria dolei*), and Maui Parrotbill (*Pseudonestor xanthophrys*). The purpose of this field project was to locate and monitor individuals and nests, identify limiting factors, and collect information necessary to understand the species' life histories. Individuals and nests of `Ākohekohe and Maui Parrotbill were located and studied from May 1994 through June 1997. BRD is currently working on the final reports for this project.

Field efforts to locate, band, and monitor the Po`ouli, `Ākohekohe, and Parrotbill actually began in April 1994. The field crew was led by BRD biologist John Simon. During the first three months of the project (April-June 1994), three days were devoted to searching for Po`ouli in the area in which the two 1993 sightings were made; however, no Po`ouli were seen (BRD 1994b).

In August 1994, an expedition was launched to search for four species of critically endangered Maui forest birds, Po`ouli, Nukupu`u, Maui `Ākepa, and Bishop's `Ō `ō (*Moho bishopi*). Two biologists with BRD, Tom Snetsinger and Michelle Reynolds, searched ridges, gullies, certain forest bird transects (8, 9, and 10 from the 1992 forest bird surveys), fence lines within the Pu`u `Alaea, Po`ouli, and Kūhiwa Units of Hanawī NAR, and the western edge of Haleakalā National Park. On August 30, 1994, they located a family group of Po`ouli, made up of one juvenile and two adults, on transect 9 in the Kūhiwa Unit at 1,915 m (6,280 ft) elevation. Follow up visits to this site resulted in the observation of a single Po`ouli by Simon and two possible auditory detections approximately 100 m (328 ft) off of the transect in an adjoining gulch by Snetsinger and Reynolds (BRD 1994a).

A second rare bird search expedition was conducted from October 19 to October 27, 1994. Snetsinger and Reynolds, along with USFWS biologists Jack Jeffrey and Rick Warshauer, Doug Pratt of the Louisiana State University Museum of Natural History, and Greg Homel searched the area again, with particular emphasis on the eastern boundaries of the Po`ouli Unit and western boundary of the Kūhiwa Unit. On October 20, Jeffrey and Reynolds observed an adult male Nukupu`u in a gulch west of the east Po`ouli fence line at approximately 1,900 m (6,250 ft)

elevation. A single adult Po`ouli was seen by Homel on October 21 in the Po`ouli Unit, and on that same day, a Po`ouli was seen by Jeffrey in the Kūhiwa Unit.

A third rare bird search expedition was conducted from February 17 to February 24, 1995, in the same areas searched in October 1994. On February 18, 1995, Snetsinger heard a Po`ouli at 1,845 m (6,060 ft) elevation. The bird was not visually confirmed. On February 22, 1995, an adult Po`ouli was seen by Snetsinger, Reynolds, and Anne Carter of TNCH, near the lower fence line of the Kūhiwa Unit east of Kūhiwa Stream.

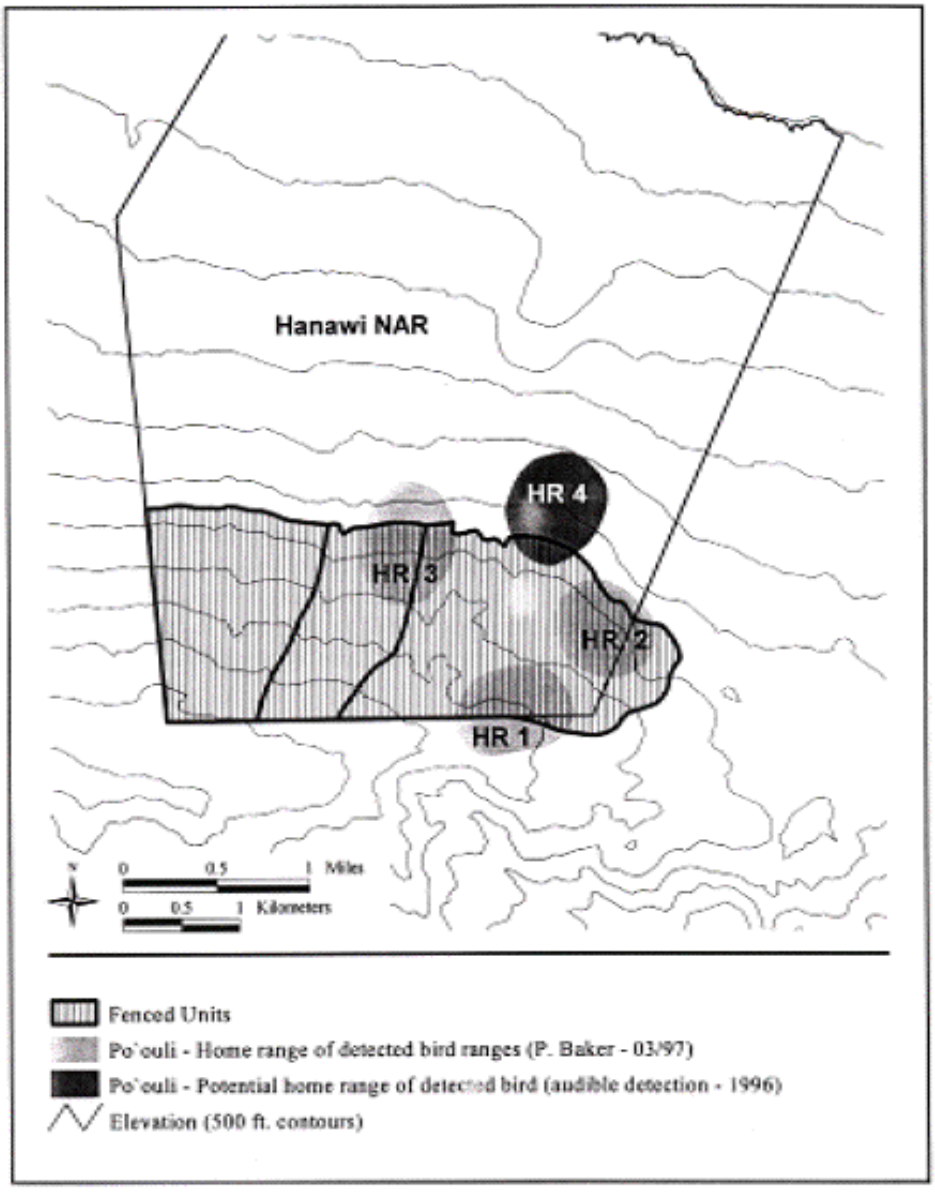
With the confirmation of the continued existence of the Po`ouli and Nukupu`u and upon the recommendation of the Hawai`i Forest Bird Recovery Team, another field effort was co-funded by the USFWS and DLNR and carried out by BRD, beginning in July 1995. Dr. Paul Baker, BRD biologist, led the field efforts, which were dedicated to locating and monitoring all remaining Po`ouli, Nukupu`u, and Maui `Ākepa; identifying those factors that have caused the decline of these East Maui forest birds; developing an effective predator control program for the removal of mammalian predators; monitoring the invasion of non-native plants into the NAR; and locating and monitoring nests of all species to potentially remove eggs, chicks, or adults for captive propagation purposes.

The BRD field crew immediately began intensive searches for Po`ouli in the areas in which the rare bird search team observed Po`ouli. During the period of October-December 1995, two sightings of Po`ouli were made in the western side of the Kūhiwa Unit, one at 1,615 m (5,300 ft) elevation on the western edge of the unit, and one at 1520 m (5000 ft) elevation near the lower fence (BRD 1995). From December 1995 to March 1997 the field crew had confirmed three locations in which Po`ouli were seen on a regular basis. These areas where identified as home range 1 (HR-1), HR-2 and HR-3 (Figure 3).

In 1996 and the early part of 1997, only four Po`ouli could be found with any regularity and another three birds were detected infrequently (BRD 1997). One adult and an immature bird were seen many times in 1996 in the area of HR-1 in the Kūhiwa Unit. Another adult was also frequently observed in 1996 in HR-2, also in the Kūhiwa Unit. The bird was seen twice in 1996 with a second bird. A third bird was infrequently encountered from December 1995 to February 1997 in HR-3 along the northwestern boundary of the Kūhiwa Unit and the northeastern boundary of the Po`ouli Unit. In February 1997 this bird was possibly accompanied by a second bird which was heard giving an alarm call; the second bird was not seen. In a fourth area (previously called HR-4), a Po`ouli was heard singing on one occasion in 1996 but this audible detection was never confirmed (Figure 3).

The existence of possibly only six birds in 1996 prompted the USFWS and DLNR to bring

FIGURE 3
Po`ouli home ranges (HR) and
fenced areas within the Hanawi NAR



together a large working group, made up of members of the USFWS, DLNR, BRD, The Peregrine Fund (TPF), National Park Service, TNCH, and KSBE, to draft a plan for management of the Po`ouli and the other endangered forest birds in Hanawī NAR and its environs. The result was the completion of a plan entitled "Initiating Recovery of the Po`ouli and other Endangered Forest Birds in East Maui" in May 1997, and the hiring of Mark Collins as the Maui Forest Bird Project Coordinator and a full-time field crew for implementation of the plan.

1.2.5 Capture, Banding, and Sex Determination of Known Po`ouli Population

In October 1996, P. Baker reported that the total known population of Po`ouli in the Hanawī NAR was six individuals made up of one pair, one adult male with one immature, one unknown sex adult, and one adult male (BRD1996b). On January 15, 1997, the field crew captured a Po`ouli in HR-2, banded it with FWS and colored bands, and fortuitously collected shed body feathers. Based on plumage coloration, the field crew identified this bird as a male. From January-March 1997, the banded bird was seen several times in HR-2. At one point, this banded individual was observed feeding one or more Maui Parrotbill fledglings, which led the field crew to believe that this individual Po`ouli had no mate. From January through July 1997, there were only two sightings of a Po`ouli in HR-1. Although elusive, another individual was seen on the border of the Po`ouli and Kūhiwa Units (HR-3) on several occasions in 1997. Thus, the Po`ouli field crew could confirm the existence of only three individual Po`ouli, although hope was still high that there were at least six individuals in the area (BRD 1997).

In July 1997 the Endangered Maui Forest Bird Project changed administration from BRD to DOFAW and a new crew took over the field responsibilities. The field crew spent their first two weeks of field work in August 1997 searching HR-1, HR-2, and HR-4 for Po`ouli. While they had several sightings of the banded individual in HR-2, no Po`ouli were seen in HR-1 or HR-4. The focus of the project at this time was to capture and band the remaining Po`ouli. Due to the degree of endangerment of this species, it was decided by the USFWS and DOFAW that body feathers would be collected instead of blood to assist the agencies in determining the sexes of the known individual Po`ouli. On January 28, 1998, the field crew finally captured the elusive HR-1 Po`ouli. In early March 1998, the HR-3 individual was also captured. Both birds were banded and body feathers were collected. These feathers, along with feathers collected from the HR-2 bird captured in January 1997, were sent to the University Diagnostics Limited (UDL) laboratory in London and the Smithsonian Institution in Washington, D.C., for DNA sexing analysis. Up to this time sexes of the Po`ouli were based on external morphological characteristics and on the birds' behaviors. The UDL lab's results identified the sexes as 1 male (HR-3) and 2 females (HR-1 and HR-2). A summary of the sexing results is attached as Appendix A.

1.2.6 Predator Control in Hanawī NAR

The Indian mongoose (*Herpestes auropunctatus*), domestic cat (*Felis catus*), and three species of rodents -- black rat (*Rattus rattus*), Polynesian rat (*Rattus exulans*), and house mouse (*Mus*

musculus) -- are known to live in the upper elevation forests of East Maui. The adverse effects of these introduced mammals on native birds, plants and invertebrates have been documented by Perkins (1903), Berger (1972), Atkinson (1977), Stone (1985), Scott *et al*. (1986), and Sugihara (1997).

In mid-November 1994, KSBE biologist Casey and Maui Critically Endangered Project research assistant Sally Atkins initiated predator control in the Kūhiwa Unit of Hanawī NAR where the Po`ouli family unit had been observed by Snetsinger and Reynolds. They spent a week in the area, placing rat tracking tunnels and laying a grid of 40 bait stations, serviced with the rodenticide Diphacinone in the form of JT Eaton® bait blocks (BRD 1994c). This grid was serviced by T. Casey until the decision was made to discontinue, as no birds were sighted during repeated visits by Casey, the rare bird survey team, and the Po`ouli field crew (BRD 1995).

By May 1996, the Po`ouli field crew had confirmed two locations in which Po`ouli were seen on a regular basis: HR-1 at 1,920 m (6,300 ft) elevation near New Greensword Bog in the Kūhiwa Unit and HR-2 located at 1,700 m (5,600 ft) elevation in the Kūhiwa Unit. The field crew initiated a systematic study of the efficacy of controlling introduced predators in Hanawī. They began by assessing the native snail population in the two areas where birds were found on a regular basis and by July 1996 had placed 56 Diphacinone bait stations, five mongoose (Fenn) traps, and 20 tracking boards in HR-1 area (BRD 1996a). In August 1996, the field crew increased the number of bait stations in HR-1 to 117, established a grid covering approximately 7 x 7 ha (17.5 x 17.5 ac), and set up a second grid in HR-2, which included 119 Diphacinone bait stations in a 7 x 7 ha (17.5 x 17.5 ac) area. The bait stations were serviced by the field crew during each field session of the project. Between December 1996 and the end of June 1997, 124 rats and 1 mongoose were caught in snap traps, 5 rats and 9 mongooses were caught in Fenn traps. No cats were captured. The Diphacinone bait stations continued to be serviced throughout this time period (DOFAW 1997a).

In July 1997 the new DOFAW Maui Forest Bird Recovery Project field crew continued the work that was begun by BRD: searching for the birds, conducting predator control in HR-1 and HR-2, and sampling snails in the treated and control plots. Between August 1997 and March 1998, two grids were maintained with 118 Diphacinone bait stations, 102 snap traps, and 54 Fenn traps in HR-1 and 125 Diphacinone bait stations, 112 snap traps and 65 Fenn in HR-2. In early September a pilot snap trapping experiment using 20 traps placed ten meters apart on a 40 x 50 m grid was conducted in HR-1 to determine the effectiveness of the bait grid and to determine the densities of rats and the minimum number of snap traps required within the treatment and control areas to sample rat abundance. The results indicated that approximately four times as many traps would be needed. The Po`ouli field crew continued to assess the effectiveness of their predator control activities in HR-2 by placing snap traps both inside and outside the treated areas in an attempt to gain a better understanding of the predator densities within the Diphacinone bait station grids. A summary of the effectiveness of the ground-based predator control in the Hanawī Natural Area Reserve was prepared by Collins (Evaluation of Ground-based Predator Control in the Hanawī

Natural Area Reserve, unpublished Report 1998).

Results of the snap trapping experiment were used to determine the relative densities of the three species of rodents and to determine the effectiveness of the ground based predator control. The results of these studies indicated that the Diphacinone bait station grids were effective in reducing the number of black rats (Control Area 19.75, Treatment Area 2.97) and house mice (Control Area 36.2, Treatment Area 5.94) in the area; however, they were not effective in reducing the number of Polynesian rats (Control Area 88.89, Treatment Area 92.09). Furthermore, Polynesian rats were found in much higher numbers than black rats in both the Control and Treatment plots. These results suggested that Polynesian rats were not being controlled as well as the black rat. (DOFAW 1997b, Collins 1998).

With the confirmation and banding of the HR-3 Po`ouli in March 1998, an assessment of the predator numbers in HR-3 was made using snap traps and cat traps. Subsequently a Diphacinone-baited predator control grid was placed in HR-3 at the beginning of May 1998. (A summary of recent predator control work was presented as a poster at the 1998 Hawai`i Conservation Conference and a written report is being prepared by DOFAW). Between July 1997 and June 1998, approximately 1,440 man-hours were spent servicing the 3 predator control grids. In early 1998 the State received approval to use a new fish-flavored Diphacinone bait to complement the peanut-buttered flavored bait to control rodents and mongooses. The new flavor is now available and has been used in HR-2. The results on the effectiveness of this flavor are still pending.

1.2.7 Avian Disease Surveillance in Hanawī NAR

Avian disease is known to have caused the decline of native Hawaiian forest bird populations and possibly contributed to the extinction of many lower elevation forest bird species (Perkins 1903, Warner 1968, van Riper *et al.* 1982). To better understand the role of avian disease as a limiting factor in the Hanawī NAR, disease monitoring activities have been an ongoing part of the Maui Forest Bird project. In November and December 1993, Dr. Carter Atkinson of the National Wildlife Health Laboratory conducted disease screenings at Hanawī NAR and TNCH's Waikamoi Preserve. The purpose of these screenings was to determine if avian pox and malaria were acting as limiting factors in the high elevation forests of Maui. Samples were taken from 147 native and non-native birds. There were no signs of pox lesions and all of the blood smears were negative for malaria (Atkinson, unpublished data 1994).

These preliminary findings are encouraging, but the impact of avian disease on upper elevation forest bird populations is still a major concern. Working in collaboration with Dr. Atkinson and Dr. Rebecca Cann (University of Hawai`i Mānoa), the Maui Forest Bird field crew has continued collecting blood for this disease survey work in order to monitor the increasing prevalence of pox and malaria in native and non-native forest birds in Hanawī and the surrounding forests, in particular the lower elevation forests.

1.2.8 Additional Field Surveys

In addition to searching the known Po`ouli home ranges on a regular basis, the Maui Forest Bird field crew has conducted three searches in Kīpahulu Valley within Haleakalā National Park since October 1997. No Po`ouli were located on any of these surveys.

In February 1998 efforts were stepped up using volunteers from other agencies and partners to search additional areas outside of the three known home ranges for Po`ouli. In March 1998, two search crews went into Hanawī NAR. The first crew, consisting of five individuals (Sharon Reilly and Fern Duvall (DOFAW), Joy Tamayose (HALE NP), Anne Carter (formerly of TNCH) and Jamie Bruch (CPSU Maui Forest Bird Project), searched in the HR-4 area below the lower elevation fence where an audible detection of Po`ouli occurred in 1997. The second crew, consisting of four individuals (J. Jeffrey (USFWS), B. Gagné (DOFAW), T. Casey (KSBE) and Valerie Stein (CPSU Maui Forest Bird Project)) searched in the area west of Frisbee Meadow and areas around Transect 8, close to where the first Po`ouli nest was discovered. No Po`ouli were sighted by either team. In mid-June 1998, two Maui Forest Bird field crew members spent 6 days searching the western boundary fence of the Hanawī NAR and the west Hanawī River. At the end of June, four people (S. Reilly (DOFAW), Jennifer Turner (DOFAW-NARS) Russell Thorstrom (TPF), and Peter Dunlevy (CPSU Maui Forest Bird Project)) searched the Pu`u `Alaea Unit and the area west of the Hanawī boundary fence. Unfortunately, no Po`ouli were located. Between August 6-13, 1998, an additional team of four (J. Jeffrey and Guy Hughes (USFWS), A. Carter, and Tracy Powers (TPF)) searched the vicinity of Smith Camp. No Po`ouli were detected.

1.2.9 Summary

The plight of the Po`ouli reflects the many problems faced by all of Hawai`i's native species. The reasons for its decline -- habitat degradation, avian disease, predation by introduced mammals, possible competition with introduced bird species, and possible lack of adequate food resources -- are the same factors that have led to the decline and extinction of several of Hawai`i's forest birds. While little has been done to assess the impacts of introduced birds on native Hawaiian forest birds, there is considerable evidence of the devastating effects of ungulates in Hawai`i's forests, avian disease (malaria and pox), and introduced mammalian predators (rats, mongooses, and cats). Ungulate control in the three managed units can be achieved through fencing and the ongoing removal of pigs. Predator control in Hanawī and surrounding areas has been less effective. Efforts to develop the best possible methods for controlling introduced mammalian predators in Hawai`i's forests have been underway for several years. The Toxicant Working Group, made up of members of several governmental agencies, private conservation organizations, and private landowners in Hawai`i, gained approval in 1994 for the use of Diphacinone bait blocks in bait stations in Hawai`i's forests. While the use of bait blocks in bait stations has been proven very effective in many areas of Hawai`i, there is an urgent need for the development of better methods for toxicant dispersal over larger areas, particularly in rugged,

remote areas like the Hanawī NAR. The Working Group continues to identify and promote studies that will be used to support an application in the near future for broader-scale methods of delivery of rodenticide in Hawai`i, such as aerial broadcast, to control introduced mammalian predators.

Avian disease research in Hawai`i, such as that currently underway by Dr. Carter Atkinson and Dennis LaPointe of BRD and Dr. Rebecca Cann of the University of Hawai`i at Mānoa, is aimed at developing methods to control the mosquito vector of avian malaria and methods to safely ascertain whether birds are infected. Other researchers are attempting to develop methods to treat infected birds and methods to promote immunity to the diseases, but more needs to be done.

During the past year, the Maui Forest Bird Field Crew has managed to confirm only three Po`ouli within three distinct and disjunct home ranges, HR-1, HR-2, and HR-3 (Fig. 3). All known birds have been captured and preliminarily sexed as one male (HR-3) and two females (HR-1, HR-2). Predator control in all three home ranges and intensive searches for additional birds continue. No interactions between the three Po`ouli have been documented. Based on BRD's estimate that the home range size of the Po`ouli is 11.2 ha (28 ac)(unpublished reports), and given the suspected sedentary nature of this bird and the distances between each home range, it is unlikely that the remaining Po`ouli will interact. Left to their own devices, it is highly unlikely that the known Po`ouli will form a pair and reproduce in the wild. The extinction of this species is believed imminent unless actions are undertaken immediately to assist in the formation of a reproductive pair of Po`ouli.

1.3 The Proposed Action

The USFWS and DOFAW are attempting to determine the best course of action to save the Po`ouli (*Melamprosops phaeosoma*) from extinction and hopefully promote the recovery of this rare bird.

1.4 Need for the Proposed Action

Only three Po`ouli are known to currently exist in a very narrow stretch of native forest on the windward slope of Haleakalā Volcano, within the Hanawī Natural Area Reserve and Haleakalā National Park. The home ranges of these birds do not overlap and the individuals have not been observed interacting with one another. There remains a chance that other Po`ouli exist undetected by field biologists. The USFWS and DLNR need to undertake actions as soon as possible to prevent further loss of individual Po`ouli and promote successful reproduction of the of the species.

1.5 Purpose of the Proposed Action

The purpose of any action taken to prevent the loss of further individuals and assist in the formation of at least one reproductive pair of Po`ouli is to prevent the imminent extinction of this species and, hopefully, increase the numbers of Po`ouli in the wild.

1.6 The Project Area

All actions proposed as alternatives in this Draft EA would take place in Hanawī NAR; portions of Haleakalā National Park; and, possibly the Maui Bird Conservation Center (MBCC) at Olinda, Maui, the Keauhou Bird Conservation Center (KBCC) at Volcano, Hawai`i, and/or another approved captive propagation facility. The 3,035-ha (7,500-ac) Hanawī NAR lies within the Ko`olau Forest Reserve in the Hāna District of Maui (Figure 1). Elevation within Hanawī NAR ranges from 610 m (2,000 ft) above Nāhiku to 2,287 m (7,500 ft) on the slopes of Haleakalā. The Po`ouli currently exists in a 121 ha (299 ac) area between 2,037 m (6,680 ft) and 1,585 m (5,200 ft) elevation.

Hanawī NAR provides habitat for the largest number and highest density of endangered forest birds in the State, and provides a habitat link between the Haleakalā National Park on its southern border and the Ko`olau Forest Reserve on its eastern and western borders (DLNR 1988).

The Keauhou Bird Conservation Center (KBCC) and the Maui Bird Conservation Center (MBCC) are two facilities in Hawai`i devoted to developing and implementing captive propagation and release techniques for endangered Hawaiian forest birds and the N n (*Nesochen* (=*Branta*) *sandvicensis*). KBCC is located on the lower Keauhou Ranch (TMK 9-9-01-4) in the Ka'ū District on the island of Hawai`i at 1,230 m (4,040 ft) elevation. The land is owned by KSBE and leased to The Peregrine Fund (TPF), and the buildings are owned by the USFWS. This facility is operated by TPF, under contract to the USFWS. The MBCC (formerly the Olinda Endangered Species Propagation Facility) is located in Olinda, Maui, on the northwestern slopes of Haleakalā Volcano, approximately 6.4 km (4 mi) from Makawao, Maui, at 1,073 m (3,520 ft) elevation (TMK 2-4-13:05). This facility is owned by DLNR and leased to TPF, and is operated by TPF under contract to DLNR.

1.7 Related Agency Actions

1.7.1 U.S. Fish and Wildlife Service Activities in the Hanawī NAR and Environs

From 1980 to 1986 the USFWS Research Division (now BRD) periodically conducted research in the Hanawī area, which resulted in life history information concerning the Maui Parrotbill (Mountainspring 1987) and Po`ouli (Mountainspring *et al.* 1990; Kepler *et al.* 1996).

From 1985 to 1994, the USFWS provided $370,000 in Federal funds to the State of Hawai`i and National Park Service to cover a portion of the costs for fencing units within Hanawī NAR and removing pigs from within the units. In 1993, the USFWS entered into a cooperative recovery project with DLNR, the National Biological Survey (NBS) (now BRD), and The Nature Conservancy of Hawai`i (TNCH) to conduct field studies of endangered forest birds on Maui. The three species targeted for this four-year project were `Ākohekohe, Maui Parrotbill, and the Po`ouli. From 1994 to 1997, the USFWS provided $277,000 to BRD to conduct these field studies in Hanawī. With the confirmation of the continued existence of the Po`ouli in 1994, a second field effort was initiated by the USFWS, DLNR, BRD, and TNCH. At that time, the project became focused on Maui Parrotbill and `Ākohekohe. From 1995 to the present, the USFWS and DLNR have provided $602,200 ($542,200 USFWS and $60,000 DLNR) to BRD and DOFAW for the field effort to locate and monitor all remaining Po`ouli, conduct predator control, and continue weed and ungulate removal activities in Hanawī NAR.

The USFWS also provides Federal funds to the State of Hawai`i for the protection and recovery of endangered and threatened species under the provisions of Section 6 of the Endangered Species Act. In addition, the USFWS administers the appropriation of Federal funds from the Pittman-Robertson Federal Aid to Wildlife Restoration program. These funds, derived from a Federal excise tax on the manufacture of arms and ammunition, are apportioned to the State Department of Land and Natural Resources for use in game management and other wildlife programs. The Pittman-Robertson funds have been used for annual forest bird surveys in the State of Hawai`i, including the 1980 and 1992 Maui Forest Bird Surveys and part of the additional surveys conducted between July 1997 and August 1998.

1.7.2 Research Activities in the Hanawī NAR and Environs

As described in 1.2.4 (above), from 1994 to 1997 BRD conducted field studies in Hanawī NAR to ascertain the status of the Po`ouli, Ākohekohe, and Maui Parrotbill; identify limiting factors; and collect basic information on these species' breeding biology, foraging ecology, and movements. In 1995 BRD initiated a second project in Hanawī NAR specifically aimed at the Po`ouli, Nukupu`u, and Maui `Ākepa. The focus of this project was to continue monitoring the individual Po`ouli that had been relocated, search all likely habitat to locate additional Po`ouli and individuals of the Nukupu'u and Maui `Ākepa, identify limiting factors, and conduct predator control. This project was transferred from BRD to DOFAW in July 1997 and continues under DOFAW today. Other research activities in the NAR include ongoing plant and invertebrate studies conducted by a variety of researchers. The NARS Commission within DLNR approves entrance into the NAR for research activities, including scientific collection.

1.7.3 Natural Resource Management in Hanawī NAR

Hanawī NAR, established in 1986 by Executive Order 3351, is part of the State of Hawai`i's Natural Area Reserve System (NARS). The NARS was created "to preserve in perpetuity specific

land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai`i" (HRS 195-1). Hanawī NAR is an important component of the East Maui watershed, harbors nine native vegetation communities, and contains nearly all of the native forest and upland birds found on the island of Maui (DLNR 1988). Three of the five endangered forest birds that occur in Hanawī NAR are critically endangered: the Po`ouli, Nukupu'u, and Maui `Ākepa. Of these, only the Po`ouli has been seen in recent years.

The current management program for Hanawī NAR is two-fold. The first priority is to control and ultimately eradicate ungulates within the reserve (DLNR 1988) in order to protect and restore the forests of East Maui as a watershed. Ungulate control (mainly pigs) has been carried out via the construction and maintenance of three fenced units -- the 202-ha (500-ac) Pu`u `Alaea Unit, the 405-ha (1,000-ac) Kūhiwa/Wai`ele`ele Unit, and the 202-ha (500-ac) Po`ouli Unit -- and the systematic removal of ungulates from within the enclosures. Efforts to eradicate pigs from within Hanawī NAR are ongoing (B. Evanson, personal communication 1998). The second priority is to limit the spread and, where possible, eradicate non-native plant species within the NAR (DLNR 1988).

1.8 Decisions to be Made Based on the Analysis

Based on the analysis documented in this Draft EA, the Regional Director of the U.S. Fish and Wildlife Service, Pacific Region, and the Chairman of the Department of Land and Natural Resources will determine the appropriate action to take to prevent the imminent extinction of the Po`ouli.

1.9 Public Involvement and Identification of Issues

The USFWS and DOFAW have worked closely and coordinated with TNCH, HALE NP, BRD, East Maui Watershed Partnership, KSBE, the Hawai`i Forest Bird Recovery Team, the Captive Propagation Recovery Working Group, Avian Disease Recovery Working Group, and former members of the Pacific Avifauna Recovery Coordinating Committee to develop this proposal and identify the issues.

This Draft EA has been prepared to share the Po`ouli's plight with as wide an audience as possible and seek input from interested and affected parties on the best possible management actions that should be carried out to prevent its extinction. A press release dated *****, and an announcement in *The Environmental Notice* (OEQC) were used to notify the public of the availability of this Draft EA and to solicit public comments.

1.10 Regulatory Authorities

1.10.1 Authorities

This action is consistent with the USFWS mandate for promoting long term conservation and recovery of the nation's endangered and threatened species (the U.S. Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1544, 87 Stat. 884) and DLNR's mandate to promote long term conservation and recovery of Hawai`i's endangered and threatened species (Hawai`i's Endangered Species Law (HRS 195D)).

1.10.2 Compliance

Any proposed management action undertaken to prevent the extinction of the Po`ouli would be completed in compliance with Federal and State policies and the following laws and regulations: National Environmental Policy Act (NEPA) of 1969, as amended; Executive Order 12372 (Intergovernmental Review of Federal Programs); Endangered Species Act of 1973, as amended; Hawai`i's Endangered Species Law (HRS 195D); and Hawai`i's Environmental Impact Statement Law (HRS 343).

1.11 Scope of Draft Environmental Assessment

This Draft EA evaluates the current status of the Po`ouli, identifies management actions that may be considered as options to prevent the extinction of this species, and solicits the input of reviewers on which of these options should be implemented either in whole or in part.

2 Chapter 2. Alternatives

2.1 Development of Alternatives

With the possibility that there may be only three individual Po`ouli extant in the wild, the USFWS and DLNR/DOFAW are faced with a very difficult situation and must make a decision on what action(s), if any, should be taken with the three known individual birds in an attempt to save this unique forest bird from extinction.

The options that have been discussed by the USFWS and DOFAW and other partners have included habitat management and possible manipulations of three known individuals. Discussions about possible translocation and captive propagation scenarios have been held in the past, and on March 24, 1998, the various options for attempting to form a breeding pair of Po`ouli were laid out by Mark Collins, the Maui Forest Bird Project Coordinator, in a document that was distributed to the partnership group and other knowledgeable reviewers. A follow-up meeting was

held on April 27, 1998, at the DLNR Board Room in Honolulu, Hawai`i, to "build a mutual understanding of the available options and to identify the risks and benefits of each of those options needed for Po`ouli recovery."

The purpose of this Draft EA is to identify the options that are being considered by USFWS and DLNR and to summarize the environmental consequences of each alternative. The agencies do not, at this time, have a preferred alternative.

2.2 Habitat Management and Expanded Searches for Po`ouli: Features Common to All Alternatives

An ecosystem-based approach to habitat management is the strategy that is being used to preserve the watershed and forest habitat in the upper portion of Hanawī NAR. Despite the successful recovery of the upper elevation forests in Hanawī, the Po`ouli population has continued to decline. The suspected causes of this decline are continued impacts of pigs on the habitat; predation of eggs, nestlings, and adults by rats and mongooses; possible competition with non-native birds; avian disease; and insufficient food resources.

Effective habitat management of the known threats will always be critical to the survival of the Po`ouli as well as to the survival of all Maui forest birds, native plants, and other wildlife. Because of this, a decision on the management of the three known Po`ouli does not preclude continuing habitat management, at some level, in order to protect any Po`ouli remaining in the wild and other endangered forest birds of East Maui. With limited resources, there will always be a question of the appropriate balance between the needs for aggressive habitat management while still addressing the critical condition of the Po`ouli and other rare forest birds.

Management actions designed to restore forest habitat over a wide area within the East Maui Watershed would include creating more managed fenced units and the subsequent removal of ungulates and weeds. It would also involve a broad-scale predator control program that would directly benefit all native forest birds by significantly reducing numbers of mongooses and rodents, which compete with birds for valuable food resources and prey on eggs, nestlings, and adult birds. Other native fauna and flora in the area would also benefit from the removal of rodents, which also feed on plants, seeds, and invertebrates.

With limited financial resources for endangered species conservation, better and more efficient methods of expanded habitat management are currently being developed. A broad-scale delivery of rodenticide is currently being examined as the most cost effective and efficient method for controlling predators over large remote areas. Preliminary studies have been conducted (Swift 1998), and are continuing, to determine the potential of this strategy for use in Hawai`i. The aerial broadcast of rodenticides is a strategy that has been used in New Zealand for the past 20 years with outstanding success in eliminating predation on ground nesting birds (Morris and Smith

1988). The estimated minimum time that it will take to complete the field studies needed to support an application for aerial broadcast of rodenticide and for the United States Environmental Protection Agency's processing and approval of the application is two years.

An expanded ecosystem management approach could reduce the potential for further losses and restore habitat for any undetected individuals that remain alive in areas outside of the existing managed units and home ranges. In addition to continuing and accelerating the ecosystem management activities in East Maui, expanded searches in East Maui to attempt to locate additional Po`ouli are currently being undertaken and will be continued. Nevertheless, should no additional Po`ouli be located, there is a risk that increased fencing, ungulate remova.l, weed control, and broad-scale predator control would not directly benefit the three known Po`ouli in time to prevent this species' extinction. For this reason, an expanded ecosystem approach is not considered a viable alternative, by itself, for saving the Po`ouli at this time.

Despite its exclusion as an alternative for the known Po`ouli, this expanded ecosystem approach to habitat management will continue to be pursued by DOFAW and the USFWS since this approach will benefit many of Hawai`i's native species. Additional funding sources for expanded habitat management are being pursued.

2.3 Po`ouli Management Alternatives

Six management alternatives are presented in this Draft Environmental Assessment. Alternative 1 is the management strategy that is currently being conducted; and for the purposes of the Federal NEPA process, is considered to be the "No Action" alternative. Alternatives 2 through 6 describe five options for manipulating the individual Po`ouli in order to initiate pair formation and reproduction. Each of the alternatives includes a discussion of their potential environmental impacts. All of the following alternatives, 1 through 6, will be done in concert with, not instead of, a continued and expanded program of habitat restoration in East Maui, predator control, searches for additional Po`ouli, and research to determine the factors that have led to the decline of the Po`ouli and other forest birds in the area.

2.3.1 Alternative 1. Current Management Actions -- no manipulation of known birds.

This alternative is considered the "No Action" category in the Federal NEPA process because it is the continuation of current management actions. Under this alternative, no changes to the current field project would occur. There would be no hands-on manipulations of the three known Po`ouli; the focus would be on monitoring the birds, predator control in the known home ranges, continued habitat management, and searches for additional birds. Efforts to expand habitat management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above). If additional birds are discovered, the same approach (i.e., no hands-on manipulation, etc.) would be taken.

If, by chance, a reproductive pair of Po`ouli is located in the wild, every effort will be made to locate the nest(s) and, if the nest is accessible and egg removal has a high chance of success, all first clutch eggs will be removed and transported to either MBCC, KBCC, or another approved facility for incubation and rearing. Second clutch eggs may also be collected, depending on such factors as how many eggs are laid, the timing in the season, etc. Under this alternative, if no reproductive pairs of Po`ouli are located and no wild nests are discovered, no steps would be taken to manipulate the adult birds in an attempt to form a reproductive pair. The three known birds may occasionally be caught in mist nets for health checks, band replacements, possible attachment of radio transmitters, etc.

2.3.2 Alternative 2. Translocate bird(s) of opposite sex to the home range of another individual and either release the bird(s) immediately (hard release) or after a short acclimatization period in a holding cage (soft release).

Under this alternative, attempts would be made to either capture the male and move him to one of the female's home range, or capture one or both females and move her or them to the male's home range. The bird(s) would be captured in mist nets and held singly at the capture site in small holding containers, padded to minimize trauma to the bird and covered with a cloth that allows air circulation but is adequately dark to calm the bird(s), and monitored by a qualified avian veterinarian. The protocols developed by the Hawai`i Forest Bird Surrogate Group (HFBSG) (Appendix B) will be used as a template; however, they will be further refined by the Po`ouli field crew and accompanying aviculturists and veterinarians by using the non-native, insectivorous Japanese bush warbler and, possibly, the native Maui Creeper, as surrogates for the Po`ouli. Food items offered to the Po`ouli will be native fruits and berries, snails, and insects, collected by the field crew at the project site, as well as non-native, live food items. The bird(s) will be held at the capture site for a period of one to two hours for health monitoring and, at the discretion of the avian veterinarian, will either be re-released to the wild at the capture site or moved to the release site via helicopter immediately following initial acclimation on the same day as its capture.

Every effort will be made to move the captured bird(s) immediately to the release site in the home range of the opposite sex bird. However, if the bird(s) cannot be released at the new release site within three to four hours of capture, it (they) will be held for a minimum of 48 hours at the release site for monitoring. Weight will be monitored at least every twelve hours. Before release, each bird will be fitted with a radio transmitter. The bird(s) will be monitored on a continuous basis to determine whether the released bird(s) stay in the home range of the opposite sex bird and whether formation of a pair bond occurs. If a pair bond is formed, every effort will be made to locate the nest(s), and if the nest is accessible and egg removal has a high chance of success, all first clutch eggs will be removed and transported to either MBCC, KBCC, or another approved facility for incubation and rearing. Second clutch eggs may also be collected, depending on such factors as how many eggs are laid, the timing in the season, etc.

Searches for additional Po`ouli in East Maui would continue and efforts to expand habitat

management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above).

The immediate environmental consequences of this action would be minimal, as there will be no aviary construction associated with this action and the bird(s) will simply be moved from one area to another within Hanawī NAR, rather than completely removed from the area. However, ongoing bird monitoring activities, such as tracking birds through the forest, may result in increased human impact on the environment. More trails may need to be established to access nesting sites or newly established home ranges.

There would be a more immediate risk of death or injury to the bird(s) from the capturing, holding, transport, and/or release. In addition, there would be a very real likelihood that the translocated wild adult bird(s) would simply disperse from the release site and not pair up with the opposite sex bird, based on the results of previous translocation attempts in Hawai`i that have involved adult Palila (*Loxioides bailleui*) (Fancy *et al.* 1997; BRD unpublished data 1996), `Ōma`o (*Myadestes obscurus*) (Fancy *et al.* in press), and Hawaiian Hawks or ‘Io (*Buteo solitarius*) (USFWS unpublished data 1997).

This option would also present a high risk of losing track of the released bird, as the radio transmitters to be used will likely have a life span of only about 2 weeks, and there is a risk that the adult released bird will disperse from the release area and fail to return to the capture site. In addition, this option would not provide additional protective measures for the Po`ouli in the wild, as there would be insufficient time to identify and control the limiting factors causing this species’ decline. And, finally, with this and all of the following alternative actions, there will be no guarantee that the Po`ouli will be able to form a reproductive pair even in the best of circumstances, as the birds may be incompatible or already too old to reproduce.

2.3.3 Alternative 3. Capture and hold one, two, or all of the remaining three individuals in holding cages and/or aviary(ies) in Hanawī NAR until a pair bond is formed, then release the pair back into the wild.

This option would require the construction and maintenance of at least one, and possibly two, field aviaries and/or holding cages within Hanawī NAR. As described in Alternative 2, attempts would be made to translocate one or more of the birds into the home range of the opposite sex bird. The captured bird would either be held at the capture site for acclimation to captivity prior to movement to the opposite sex bird’s home range, or moved immediately. The translocated birds would be placed into another field aviary or holding cage in the opposite sex bird’s home range, where the bird would be held in an attempt to attract the opposite sex bird. If the opposite sex bird is attracted to the cage and the birds appear to be forming, or are likely to form, a pair bond, the bird may be released from the holding cage/aviary after being fitted with a radio transmitter. Or, to strengthen the pair bond before release of the bird, the opposite sex bird may be captured and placed in the holding cage/aviary with the translocated bird. The avian

veterinarian and qualified aviculturist will be on hand at all times to monitor the birds and recommend whether or not to continue holding one or both of the birds.

Once a pair bond is established, both birds would be released to the wild after being fitted with radio transmitters and allowed to breed in the wild under surveillance by the field crew. Every effort would be made to locate the nest(s) and, if the nest is accessible and egg removal has a high chance of success, all first clutch eggs would be removed and transported to MBCC, KBCC, or another approved facility for incubation and rearing. Second clutch eggs may also be collected, depending on such factors as how many eggs are laid, the timing in the season, etc.

Searches for additional Po`ouli in East Maui would continue and efforts to expand habitat management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above).

Capturing wild birds and holding them in captivity, even for a short period of time, carries with it many risks. The birds may be injured or may die during capture and transport and/or may not acclimate to a captive environment and may perish from stress or related illnesses.

Under this alternative, there would be a greater impact to the environment than in Alternative 2 because of the construction of holding cages or field aviary(ies). The monitoring activities after release would be the same as in Alternative 2 and would have the same impact on the environment. The risks to the birds after release are also the same as in alternative 2. The benefit of this option is to initiate pair bond formation before the translocated bird is released back to the wild, making it more likely that reproduction would occur.

2.3.4 Alternative 4. Capture and hold two or all of the remaining three individuals in holding cages and an aviary(ies) in Hanawī NAR for attempted captive propagation and subsequent release of the adults and/or young back into the wild.

This alternative combines aspects of Alternatives 2, 3 and 5 (the latter described below). It would involve the capture of two birds and translocation of at least one but possibly two birds, the construction and maintenance of at least one field aviary in the Hanawī NAR, and a full-time staff to care for the birds while being held in captivity in the field. The birds would be placed into a holding cage and/or field aviary within Hanawī NAR in one of the home ranges for pair bond formation and attempted captive propagation.

If a pair forms and successfully nests, all first clutch eggs would be removed and transported to MBCC, KBCC, or another approved facility for incubation and rearing. Second clutch eggs may also be collected, depending on such factors as how many eggs are laid, the timing in the season, etc. If propagation is successful, the resulting young and, possibly, the adults themselves would be released to the wild.

Searches for additional Po`ouli in East Maui would continue and efforts to expand habitat management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above).

This option would be more costly than the previous three options presented, as it would require not only the construction of a suitable field aviary or holding cage(s), but also the hiring and maintenance of adequate staff to manage the Po`ouli on site for an extended period of time. Living space will also need to be constructed in the immediate vicinity of the aviary for the staff that will be caring for the Po`ouli and maintaining the field aviary or holding cage(s). Given the remoteness of the site and the vagaries of weather that many times prevent travel into and out of Hanawī NAR by helicopter, this option also presents logistical difficulties for maintaining adequate health care for the birds. Impact to the environment would be high due to the construction of a permanent field aviary and the constant presence of staff.

The benefit to holding birds in a field aviary or holding cage(s) for captive breeding rather than at MBCC, KBCC, or another approved facility will be that immediate re-release to the wild at or near the original capture site can occur if deemed necessary for the health and survival of the birds.

2.3.5 Alternative 5. Capture and hold one, two, or all of the remaining three individuals in holding cages and an aviary(ies) in Hanawī NAR until a pair bond is formed and/or the birds are acclimated to captivity, then transfer the birds to MBCC or another approved facility for attempted captive propagation.

Under this option, rather than immediately transporting captured Po`ouli to MBCC or another approved facility for captive propagation purposes (as in Alternative 6 described below), the birds would be held in holding cage(s)/field aviary(ies) within Hanawī NAR, in accordance with the procedures described under alternative 4 (above), until such time that a pair bond is formed.

Again, the birds would be captured, transported to, and held in the field aviary(ies) as described above in Alternatives 3 and 4. Once a pair bond is formed and the birds have acclimated to captivity in field aviary(ies), they would be transported to MBCC or another approved facility for captive breeding purposes. The bird(s) will be accompanied to the facility by a qualified avian veterinarian, who will be responsible for monitoring the health of the bird(s) during transport and for recommending and implementing safer methods of holding and transport if deemed appropriate. The bird(s) will be held singly in small holding containers as described above and transported via the quickest and safest conveyance as possible, such as helicopter, automobile, or truck, from the field site directly to the facility. All efforts will be made to ensure that the total time elapsed from capture of the bird(s) to arrival at the propagation facility will not exceed 3 hours. Upon arrival at the captive propagation facility, qualified aviculturists and the avian veterinarian(s) will be responsible for housing and caring for the individual birds and acclimating them to captivity with the ultimate goal of establishing at least one reproductive pair. The goal

will be to increase the numbers of Po`ouli through captive propagation.

Searches for additional Po`ouli in East Maui would continue and efforts to expand habitat management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above).

The risks to the birds while being held in a field aviary would be the same as in Alternatives 3 and 4. The impact to the environment would not be as significant as Alternative 4 because of the shorter duration that a field crew would be needed to care for the birds being held in the field aviary. Since the birds would not be released, there would be less of an impact to the environment due to field monitoring activities.

The main benefit of this option is the ability to release birds back into the wild should they be unfit for captivity or unable to form a pair bond while being held in the field aviary.

2.3.6 Alternative 6. Capture two or all of the remaining three individuals and take them immediately into captivity at MBCC or another approved facility for attempted captive propagation.

Under this alternative, attempts will be made to capture a pair of birds of opposite sex, or possibly all three birds, and take them into captivity for attempted captive propagation at either MBCC or another approved facility. The birds would be captured and transported to the facility in the same manner as in Alternative 5 and would be accompanied by a qualified avian veterinarian, who will be responsible for monitoring the health of the bird(s) during transport and for recommending and implementing safer methods of holding and transport if deemed appropriate. The bird(s) will be transported in the above-described container (or other transport container approved by the avian veterinarian) via the quickest and safest conveyance possible, such as helicopter, automobile, or truck, from the collection site directly to KBCC or MBCC. Total time elapsed from capture of the bird(s) to arrival at the propagation facility will not exceed 3 hours. Upon arrival at the captive propagation facility, qualified aviculturists and the avian veterinarian(s) will be responsible for housing and caring for the individual birds and acclimating them to captivity with the ultimate goal of establishing at least one reproductive pair. The goal will be to increase the numbers of Po`ouli through captive propagation.

Searches for additional Po`ouli in East Maui would continue and efforts to expand habitat management and predator control activities outside of the currently known home ranges would accelerate (see 2.2 above).

The goal of the captive propagation effort will be first and foremost to prevent the extinction of the Po`ouli through increasing the numbers of individuals and second to reestablish the Po`ouli in the wild where the threats that have contributed to its decline are controlled. Reestablishment sites within the historic range of the Po`ouli outside of Hanawī NAR will also be considered for

management and reintroduction of the Po`ouli. Appropriate disclosure documents will be prepared under the National Environmental Policy Act of 1969 (NEPA) and Hawai`i's Environmental Impact Statement law (HRS 343) prior to reintroduction of captive-bred Po`ouli.

Taking birds from the wild into captivity carries with it many risks. The birds may be injured or may die during capture and transport and/or may not acclimate to a captive environment and may perish from stress or related illnesses. Furthermore, even if the birds acclimate to captivity, there is no guarantee that the birds will form a reproductive pair and produce young in captivity. Nevertheless, when the chances of increasing reproduction and survival in the wild are low or nil and when there is little possibility that eggs will be produced by a wild pair for collection, the removal of individuals from the wild for the initiation of a captive propagation program may be the only available option and has been used in several recovery programs nationwide and internationally (e.g., `Alala, Laysan Duck, N n , California Condor, Puerto Rican Parrot, Guam Rail, Micronesian Kingfisher, Bali Myna, etc).

Anticipating that captive propagation using captured wild birds (rather than eggs) would likely be necessary for some of Hawai`i's forest birds, the USFWS entered into a cooperative agreement in 1986 with various zoological institutions to develop techniques for capturing, transporting, acclimatizing, and breeding Hawaiian forest birds, using surrogate species for Hawai`i's endangered and threatened birds. The zoological institutions undertook three collection trips, in 1988, 1991, and 1992. (A summary of this surrogate work is provided in Appendix C). A total of 208 `Amakihi (*Hemignathus virens virens*), 152 `I`iwi (*Vestiaria coccinea*), 17 `Ōma`o, and 27 `Apapane (*Himatione s. sanguinea*) were captured. Of these, 293 were released at the capture site upon the advice of the avian veterinarian and aviculturists who participated in the capture, in accordance with the protocols. There were no mortalities or injuries during capture, holding, and transport in 1988 or 1991, although several birds died after arrival and holding at the zoological institutions. In 1992, one `Amakihi and one `I`iwi were killed by `Io immediately upon being caught in the mist-nets; one `Amakihi was injured in the mist-net and was euthanized; and, one `Amakihi died due to stress during the field acclimation phase. A total of 65 `Amakihi, 31 `I`iwi, 9 `Ōma`o, and 5 `Apapane were transported to the Honolulu Zoo and mainland zoological institutions. Of these, 19 of the original wild-caught `Amakihi still survive, 13 of the `I`iwi, 4 of the `Ōma`o, and all 5 of the `Apapane (S. Derrickson, National Zoological Park-Conservation and Research Center (NZP-CRC), unpublished data 1998; Appendix C).

Thus far, captive breeding has occurred in all four species. There are 5 pairs of `Amakihi, four of which have produced eggs. Sixteen young have been hatched at the National Zoological Park's Conservation and Research Center in Front Royal, Virginia (NZP-CRC) from two of these pairs. Two were hatched on June 10, 1998, and appear to be healthy. Six young fledged successfully and five of these still survive. Three pairs of `I`iwi have been established, two of which have produced eggs. Two chicks have been hatched, with one raised successfully by the parents in 1995. Unfortunately, this bird died in 1997 of a spinal tumor. Honolulu Zoo, which currently holds one of the originally caught `Apapane and 4 other birds that were caught elsewhere, has

hatched 5 chicks from 2 different pairs in 1996 and 1997; all were raised to fledging, but none have survived to adulthood. Houston Zoo has hatched 16 `Ōma`o chicks from 2 pairs of birds since 1995. Five of these chicks have been successfully raised (2 by their parents and 3 through hand-rearing) (S. Derrickson, unpublished data 1998).

This option optimizes the chances that the birds will be given the best possible care by highly qualified staff in state-of-the-art facilities, where their lifespans may be increased, threats controlled, and reproduction encouraged. However, removal of perhaps the last three Po`ouli from the wild is considered a last-ditch effort to save this species and is charged with emotion. Many people believe that a species should be left in the wild, rather than be brought into captivity if there's a chance that death may occur in captivity. The environmental consequences of this action may include: 1) the removal of all known individual Po`ouli from the wild to increase their numbers, identify and control the threats to their continued survival in the wild, and release progeny of these birds into suitable habitat in the future; 2) the possibility of death or injury to the bird(s) at any stage during capture, transport, and holding in captivity; and, 3) the possibility that the threats in the wild will not be managed in a manner sufficient to return the Po`ouli to its natural environment.

2.4 Comparative Evaluation of Alternatives

Alternative 1. Current Management -No Manipulation of Known Birds

Pros: Po`ouli would *not* be captured for the purpose of moving them to home ranges of other Po`ouli or to a captive breeding facility. This alternative eliminates the potential of injury or death due to stress associated with handling or prolonged periods of capture and holding that might be associated with the following alternatives. Since this alternative does not require additional expenditures of dollars for the construction and operation of a field aviary, additional resources could be obtained and used to accelerate habitat management, predator control, and Po`ouli searches in East Maui.

Cons: Since surveys conducted in 1980, the Po`ouli's population has declined steadily from around 280 individuals (Scott *et al*. 1986) to only the present three individuals now known to be alive. Since it is not known to what factor(s) this decline can be attributed, it is impossible to know what management action(s) should be implemented in the field to reverse the current downward trend. In addition, the three remaining Po`ouli occur in home range areas that do not overlap. These birds have never been observed interacting, nor outside of their known home ranges. There is a high probability that they do not know of each others existence and therefore, the chance of a breeding pair being established in the wild seems highly unlikely.

Alternative 2 - Translocation and release

Under this alternative, one or two birds would be captured within her/his home range, promptly transported to the home range of a bird of the opposite sex, and (1) be promptly released (hard release), or (2) be monitored in a holding cage prior to release (soft release).

Pros: The "hard" release would minimize the chances of a captured bird dying while being held in captivity. It is designed to place birds of opposite sex in the same home range area to initiate pair bond formation.

The "soft" release option would allow for observations of the captive bird and would help the bird acclimate to its new surroundings. This option would, hopefully, increase the likelihood that the translocated bird would stay in the area and would increase the likelihood that it would encounter the resident Po`ouli.

Since this alternative does not require additional expenditures of dollars for the construction and operation of a field aviary, additional resources could be obtained and used to accelerate habitat management, predator control, and Po`ouli searches in East Maui.

Cons: Under the hard release option, while the bird(s) might not die while in the possession of the biologists, the bird(s) could still suffer due to stress or other injury that was incurred during capture and transport. In such an event, the release of such a bird into an area that is not its own home range would increase the chances that the bird(s) would not survive. Another event that has occurred in similar hard releases is that the released bird quickly departs from the new area, often returning to its former home range or simply disappearing. Under such a scenario, it is possible that the released bird might not be found again. In addition, a rapid release such as this would likely not result in the formation of a pair bond since the resident bird might not be present at the time of release and since the bird being released would likely depart from the area shortly after release. Even in the event that the resident bird was present at the time of release, given the abruptness of the encounter ("introduction"), there is a chance that the encounter would be aggressive rather than pair-forming. Lastly, such a displaced bird would more likely fall victim to environmental vagaries (*e.g.*, predation or lack of shelter), especially with the added element of stress.

Under the soft release option, the translocated bird could still leave the area immediately upon release. Under both the hard and soft release options, there is no guarantee that a pair bond would form between two birds. Even in the event that a pair bond is established and the birds produce viable eggs, the nest and any resultant nestlings would still be exposed to a habitat where this species of bird has been declining for years.

Alternative 3 - Hold in Field Aviary then Release Pair

Pros: A field aviary for holding the birds in the hope that they form a pair bond would keep the birds in a relatively natural setting. Under these conditions it is felt that stress would be minimized. Birds could be kept isolated from one another and introduced slowly to help ensure that no aggressive encounters would occur. It would also allow for the potential for a natural formation of a pair bond between the birds. This alternative would also allow for prompt release of one or more birds should they exhibit complications due to holding in captivity. Maintenance of the field aviary and its associated environmental impacts would be for a shorter duration than that proposed for Alternative 4. The shorter duration of this field aviary would simplify the operation.

Cons: The construction and maintenance of a field aviary would be costly, environmentally damaging, and difficult logistically. Once birds were placed within the aviary, an attentive staff would have to be present constantly. Given the large amount of time it is felt it would require to establish a pair bond between the two birds, it would become more likely that some complication would arise with the field aviary setting. Providing food for the birds for extended periods could prove to be very difficult. The field aviary and the captive birds would be susceptible to damage from harsh weather conditions, and any breach of the enclosure by predators (*e.g.*, mongooses, rats), would likely be fatal to one or all of the birds. Lastly, release of the paired birds into the field would likely not result in an increase in the population, since this species has declined steadily in the wild and the limiting factors are not well understood or adequately controlled.

Alternative 4 - Hold long-term in Field Aviary for Captive Propagation

Pros: A field aviary for captive breeding within the birds' natural habitat would, if the birds adapt to captive holding, keep the birds in a relatively natural setting. Under these conditions it is felt that stress would be minimized. Birds could be kept isolated from one another and introduced slowly to help ensure that no aggressive encounters would occur. It would also allow for the potential for a natural formation of a pair bond between the birds. It would also allow for prompt release of one or both birds should some complication due to captive holding arise. Should nesting result, the eggs could be easily collected and taken to a captive breeding facility for rearing, with the hope that the adult birds would double clutch. Under these conditions, mortality of nestlings, due to predation or other, unknown field threats, could be reduced.

Cons: The construction and maintenance of a field aviary would be costly, environmentally damaging, and difficult logistically. Once birds were placed within the aviary, an attentive staff would have to be present constantly. Providing food for the birds for extended periods could prove to be very difficult. The field aviary and the captive birds would be susceptible to damage from harsh weather conditions, and any breach of the enclosure by predators (*e.g.*, mongooses, rats), would likely be fatal to one or all of the birds. Given the large amount of time it would likely require to establish a pair bond and produce eggs, it would become more likely that one or

more of the above complications would arise within the field aviary setting.

Alternative 5 - Hold in Field Aviary till Pair Forms, then Transfer to MBCC or Another Approved Facility

Pros: This alternative allows for the formation of a natural pair bond under relatively natural field conditions (field aviary). It allows for rapid release of the birds into the field if stress or other factors appeared to be contributing to their decline. These acclimated birds could then be moved into a captive breeding facility with reduced risk of stress-related trauma. The previously formed pair bond would likely increase the chances of successful establishment in a captive breeding facility and would increase the chance of successful nesting of the birds once placed in that facility. Establishing a pair of mating birds in a captive breeding facility would provide a higher probability of successful nesting. As with Alternative 4, this option could result in the greatest returns for double clutching and rearing of the greatest number of Po`ouli.

Cons: This alternative poses the difficult logistics of establishing and maintaining a field aviary until a pair bond is formed (an unknown amount of time), with the same risks that were identified for Alternatives 3 and 4 (above). In addition, once the birds are transferred to MBCC or another approved facility, it bears the same risks inherent in bringing birds into captivity (*e.g.*, stress, inability to quickly release the birds into the field), although to somewhat of a lesser degree than in Alternative 6 (below).

Alternative 6 - Immediately Bring to MBCC or Another Approved Facility for Captive Propagation

Pros: This alternative provides the most control over the well-being of the birds. The birds would be protected from predation and severe inclement weather (as could be encountered in other alternatives) if placed in a captive breeding facility. Keeping the paired birds together under these controlled conditions would, if the birds adapt to captivity, assist in the formation of a pair bond, and assure protection of any eggs and offspring that result from the pairing. This scenario would lend itself well to producing multiple broods via double-clutching, thus providing the largest possible returns over the shortest period. Given the apparent lack of reproduction in their native habitat, and success to date in hatching the eggs of other forest bird species and rearing them to adulthood, this would provide the fastest means of producing birds for continued captive breeding, or release into the wild. Since this alternative does not require additional expenditures of dollars for the construction and operation of a field aviary or captive propagation facility, additional resources could be obtained and used to accelerate habitat management, predator control, and Po`ouli searches in East Maui.

Cons: While possibly providing the highest conservation pay-offs of all of the alternatives, this alternative is also one of the most risky. Once a bird or birds are moved to the rearing facility, returning it/them to the wild would be difficult. Should illness or stress-related injury or poor

health become evident, there is a chance that the bird(s) would not recover. At such a critical point, returning the bird(s) to the wild would likely be ruled out since the stress associated with such movement would likely result in the loss of the bird(s).

While insectivorous passerines have been successfully reared from eggs and chicks, bringing wild birds into captivity has a high likelihood of failure. Even in the event that these birds adapt to captivity and form a pair, it would likely be a year or more before any nesting attempt was made.

Table 2-1. Comparison of Alternatives.

ISSUES	ALTERNATIVE					
	ALTERNATIVE #1 CURRENT MANAGEMENT-NO MANIPULATION OF KNOWN BIRDS	ALTERNATIVE #2 TRANSLOCATION AND RELEASE	ALTERNATIVE #3 HOLD IN FIELD AVIARY FOR PAIR FORMATION	ALTERNATIVE #4 HOLD LONG-TERM IN FIELD AVIARY	ALTERNATIVE #5 HOLD IN FIELD AVIARY/ TRANSFER TO CAPTIVITY	ALTERNATIVE #6 CAPTIVE PROPAGATION
Likelihood of death or injury to the three known birds.	Med/High	High	High	High	High	High
Likelihood of pair bond formation with three known birds.	Low	Low/Med	Med/High	Med/ High	High	High
Adequate protection of three known birds from threats.	Low	Low	Low/Med	Med/ High	Med/High	High
Ability to monitor the three known birds.	Low/Med	Low/Med	Med/High	High	High	High
Impact on the natural environment.	Low/Med	Low/Med	High	High	High	Low
Cost	Low/Med	Low/Med	High	High	High	Med/High

Table 2-2. Pros and Cons of the Alternatives. See section 2.4 for more details.

ALTERNATIVES	ALTERNATIVE #1 CURRENT MANAGEMENT-NO MANIPULATIONS OF KNOWN BIRDS	ALTERNATIVE #2 TRANSLOCATION AND RELEASE	ALTERNATIVE #3 HOLD IN FIELD AVIARY FOR PAIR FORMATION	ALTERNATIVE #4 HOLD LONG-TERM IN FIELD AVIARY	ALTERNATIVE #5 HOLD IN FIELD AVIARY/TRANSFER TO CAPTIVITY	ALTERNATIVE #6 CAPTIVE PROPAGATION
PROS	Minimal handling of adult Po`ouli; therefore, low risk of death or injury attributable to hands-on management activities.	Birds held in cages or aviary for minimal amount of time.				
	Keeps birds in natural habitat.	Keeps birds in natural habitat.	Keeps birds in somewhat natural surroundings.	Keeps bird in somewhat natural surroundings.	Allows birds to acclimate to captivity and form pair bond in somewhat natural surroundings.	
		Allows for prompt release of birds if necessary.	Allows for prompt release of birds if necessary.	Allows for prompt release of birds if necessary.	Allows for prompt release of birds if necessary.	
				If nesting occurs, eggs can be easily located and collected for incubation and rearing at captive breeding facility.	If nesting occurs, eggs can be easily located and collected for incubation and rearing.	If nesting occurs, eggs can be easily located and collected for incubation and rearing.
			Birds kept in an environment that is relatively secure from threats until pair bond is formed.	Birds kept in an environment that is relatively secure from threats.	Birds kept in an environment that is relatively secure from threats.	Birds kept in an environment that is relatively secure from threats.

Table 2-2. Pros and Cons of the Alternatives. See section 2.4 for more details.

ALTERNATIVES	ALTERNATIVE #1 CURRENT MANAGEMENT-NO MANIPULATIONS OF KNOWN BIRDS	ALTERNATIVE #2 TRANSLOCATION AND RELEASE	ALTERNATIVE #3 HOLD IN FIELD AVIARY FOR PAIR FORMATION	ALTERNATIVE #4 HOLD LONG-TERM IN FIELD AVIARY	ALTERNATIVE #5 HOLD IN FIELD AVIARY/TRANSFER TO CAPTIVITY	ALTERNATIVE #6 CAPTIVE PROPAGATION
PROS	Low cost relative to other alternatives, which may allow for a more accelerated approach to habitat management, predator control, and expanded searches.	Low cost relative to other alternatives, which may allow for a more accelerated approach to habitat management, predator control, and expanded searches.				Since captive propagation facilities are already built and operating, cost is minimized, which may allow for a more accelerated approach to habitat management, predator control, and expanded searches.
CONS	Remaining wild Po`ouli may not pair and reproduce.	Limited opportunity for birds to form a pair bond.				
			Birds may not adapt to captivity and may die before reproducing.	Birds may not adapt to captivity and may die before reproducing.	Birds may not adapt to captivity and may die before reproducing.	Birds may not adapt to captivity and may die before reproducing.
	Birds still exposed to uncontrolled agents of mortality.	Birds still exposed to uncontrolled agents of mortality.	Inclement weather could damage aviary and/or birds and allow the entrance of predators.	Inclement weather could damage aviary and/or birds and allow the entrance of predators.	Inclement weather could damage aviary and/or birds and allow the entrance of predators.	Birds could not be immediately released to the wild.

Table 2-2. Pros and Cons of the Alternatives. See section 2.4 for more details.

ALTERNATIVES	ALTERNATIVE #1 CURRENT MANAGEMENT-NO MANIPULATIONS OF KNOWN BIRDS	ALTERNATIVE #2 TRANSLOCATION AND RELEASE	ALTERNATIVE #3 HOLD IN FIELD AVIARY FOR PAIR FORMATION	ALTERNATIVE #4 HOLD LONG-TERM IN FIELD AVIARY	ALTERNATIVE #5 HOLD IN FIELD AVIARY/TRANSFER TO CAPTIVITY	ALTERNATIVE #6 CAPTIVE PROPAGATION
CONS		Birds could be injured or die from handling and transport.	Birds could be injured or die from handling and transport.	Birds could be injured or die from handling and transport.	Birds could be injured or die from handling and transport.	Birds could be injured or die from handling and transport.
			Construction and maintenance of field aviary and staff facilities are logistically difficult and costly.	Construction and maintenance of field aviary and staff facilities are logistically difficult and costly.	Construction and maintenance of field aviary and staff facilities are logistically difficult and costly.	
			Impacts to the environment would be high due to aviary construction and ongoing bird care and monitoring activities.	Impacts to the environment would be high due to aviary construction and ongoing bird care and monitoring activities.	Impacts to the environment would be high due to aviary construction and ongoing bird care and monitoring activities.	
		Difficulties in locating future nests would not allow for maximum nest protection and reproductive output through double-clutching, etc.				
		Translocated bird likely to leave area.				

3 Chapter 3. Affected Environment

3.1 Overview of the Project Area

The island of Maui is the second largest island in the Hawaiian Archipelago (Figure 4). The island has an area of approximately 1,887.6 km^2 (188,760 ha or 466,426 ac) and is approximately 73 km (45 miles) long and 40 km (25 miles) wide. The major city on the island is Kahului, located on the north of the isthmus between 20^0, 52' and 20^0, 54' north latitude, and from 156^0, 27' to 156^0, 31' west longitude. Mountainous forested areas where the Po`ouli is known or suspected to have occurred lie due east, approximately 30 km (18.6 miles), of this population center.

These mountainous areas are directly exposed to the prevailing trade winds, which deliver an average of 880 cm (350 in) of rain annually, and are technically classified as rain forest. Forests at lower elevations are dominated by alien plants, with native forests being restricted to elevations above 900 m (3,000 ft). The north slope of Haleakalā reaches an altitude of 2,713 m (8,900 ft), where night time winter temperatures frequently drop below freezing.

Although the original range of the Po`ouli is not known, fossil evidence indicates that these birds were once found in dry to mesic habitats of the southwestern portion of east Maui (Pratt *et al.* 1997). Since its discovery in 1973, the Po`ouli has only been recorded to occur in the wet, montane forests of the upper Hanawī area (Figure 3) between the elevations of 1,418 and 2,037 m (4,650-6,680 ft). The three known Po`ouli are restricted to a total area of approximately 121 ha (299 ac).

A small portion of one or two of the three Po`ouli home ranges would be temporarily altered (Alternatives 3-5) due to the construction of a field aviary(ies) and field camp(s). It is possible that temporary field camps and small holding cages would be constructed in or adjacent to all three of the known Po`ouli home ranges.

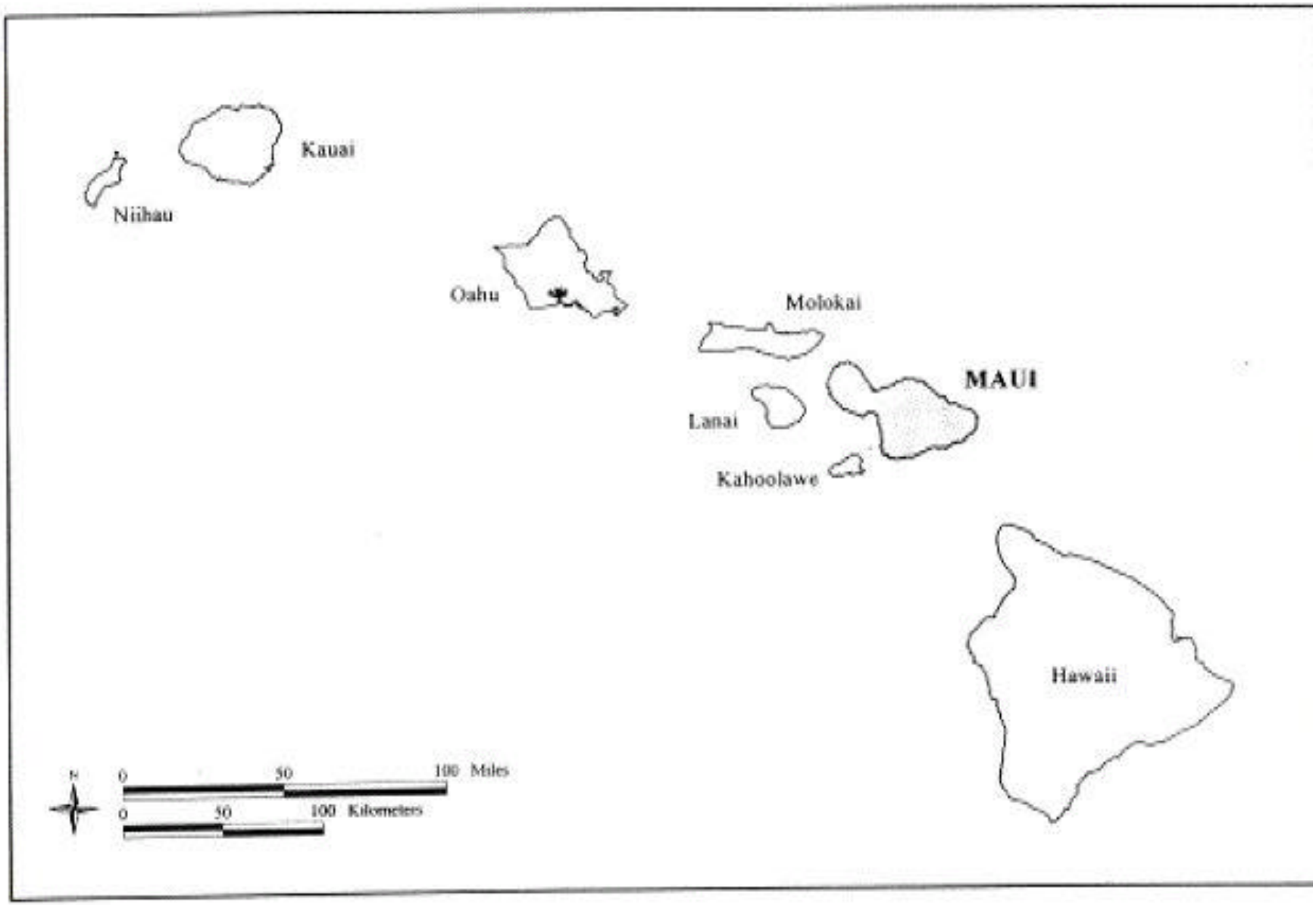
3.2 Physical Environment

3.2.1 Volcanology, Topography, Soils, and Climate

The Hawaiian Islands were formed by multiple, relatively small eruptions of thin-bedded flows, which were seldom thicker than 3 m (9.8 ft). The fluid nature of Hawaiian lava resulted in the formation of gently sloping shield volcanoes (Stearns 1985), as illustrated by Mauna Loa on the youngest island of Hawai`i. As one moves west along the island chain, the gradual sloping nature of the shield volcanoes becomes less and less evident due to erosional effects over time.

Due to the regular and heavy rain fall brought on by the trade winds to the northeast slopes of Haleakalā, the north-facing slopes are bisected by stream and river drainages. The broad and

Figure 4
Hawaiian Islands



narrow ridges are separated by steep, vegetated slopes with intermittent rock exposures. Streams descend rapidly, dropping from elevations of greater than 2,700 m (8,850 ft) to sea level in only 12 km (7.5 mi). Cataracts and waterfalls are common features on all streams of the area. Unlike continental volcanoes, the Hawaiian Islands were/are formed by heavier, basaltic, and some andesitic lavas. Therefore, the soils that result from the breakdown of these volcanic rocks are low in silicates while being high in iron and aluminum (Street 1989). Except for some coastal areas, the soils are free of sand. Well formed, deep humic latosols occur in wetter Hawaiian climates such as Hanawī. These soils are highly permeable and their clay-like texture make them relatively resistant to erosion. Soils of wetter habitats, like those of the Hanawī rainforest, contain 8-10 percent organic matter and are acidic in nature (Street 1989).

The prevailing trade winds as well as winter storm systems typically approach the Hawaiian Islands from the north (northeast and northwest, respectively). Due to the great elevational height of Haleakalā (3,048 m (10,000 ft)), much of the moisture carried in these accompanying clouds and weather systems is dropped along the large elevational gradient of the volcano slope. As a result, the Hanawī area receives an average of 880 cm (350 in) of rain annually.

3.2.2 Hydrology and Water Resources

The Hanawī rainforest lies within the east Maui watershed. Water from most of the streams that drain down slope to the north are tapped by a series of flumes, the Ko`olau and Wailoa Ditch System. This water source, as well as that from west Maui, provides for the agricultural and urban needs of Maui residents and visitors.

3.3 Social and Economic Environment

3.3.1 Land Ownership

There will be no change in land ownership as a result of the proposed actions. All management considerations within this Draft EA are on lands owned by the Federal government and the State of Hawai`i and are set aside as a National Park and conservation lands under the management of the Natural Area Reserve System (NARS), Department of Land and Natural Resources.

3.3.2 Land Use

All lands within the Hanawī NAR are zoned as Conservation lands. The area is remote and the few trails that exist are not well maintained. There are no roads within the Hanawī NAR, and access is by foot or helicopter. This area serves as part of the east Maui watershed, but no resource extraction is allowed.

3.3.3 Public Use

Lands zoned as Conservation are separated into four different use categories. Hanawī NAR is classified as Protected, receiving the most stringent protection of any State conservation lands. While some NAR lands are used in a limited recreational fashion by the public, the Hanawī NAR is not. Use of this area is by permit only and typically restricted to uses such as research and land management.

3.3.4 Archaeological and Historical Resources

While archaeological resources have been located within more open areas of Haleakalā National Park (which lies adjacent to the Hanawī NAR), little in the way of such resources have been found in high elevation wet forests. None are known to occur within the Hanawī NAR.

3.4 Biological Environment

3.4.1 Native Biological Diversity

The upper elevation wet forests of northeast Maui support a high diversity of native plants and insects. Although the lower elevations are largely invaded or dominated by numerous alien plant species, the upper elevation wet forests support large expanses of native forest, typically with only scattered or incipient pockets of alien plants. Dominant forest trees, which make up a large portion of the habitat, include: `ōhi`a-lehua (*Metrosideros polymorpha*), `ōlapa (*Chirodendorn trigynum*), alani (*Melicope* spp.), kōlea (*Myrsine* spp.), and kāwa`u (*Ilex anomala*). Common understory plants include: pūkiawe (*Styphelia tameiameaie*), pilo (*Coprosma montana*), `ākala (*Rubus hawaiensis)*, and `ūhule (*Dicranopteris linearis*). A number of the woody trees are often found as understory plants and some of the plants noted here as understory periodically become components of the canopy. Numerous other common species are found in the understory or canopy, as ground cover or as epiphytes.

Insect diversity, while felt to be fairly high, has been little studied. However, given the large portion of intact, native forest, with numerous endemic plants, the number of endemic insects can be assumed to be quite high. Endemic snails, while not as diverse as those of west Maui, can be locally common at lower and mid-elevations and include the genera *Succinea, Auriculella*, and *Elasmias*.

There is also a relatively healthy diversity of native birds in this area. Commonly encountered honeycreepers include: `Apapane, `Amakihi, Maui Creeper (*Paroreomyza montana*), and `I`iwi. All of these species are most common at higher elevations (above 1,390 m (4,500 ft)), where it is felt that malaria-bearing mosquitos do not reproduce or occur with great frequency. However, even though these species do occur at lower elevations than the rarer forest birds, they become

increasingly rare at elevations below about 1,500 m (4,920 ft) (Scott *et al.* 1986).

3.4.2 Rare, Endangered, and Threatened Species

There are no fewer than 18 rare plants known from the windward forests of east Maui, eight of them listed as endangered (E) under the U.S. Endangered Species Act of 1973, as amended (ESA), or proposed (P) for listing as endangered. Endangered and proposed plants include: *Clermontia oblongifolia* ssp. *mauiensis* (E), *Clermontia samuellii* (P), *Cyanea mceldowneyi* (E), *Geranium arboreum* (E), *Geranium multiflorum* (E), *Melicope balloui* (E), *Melicope ovalis* (E), and *Platanthera holochila* (E). Within the Hanawī NAR two endangered and one proposed plants have been documented: *Clermontia samuelli* (P), *Geranium multiflorum* (E), and *Plantanthera holochila* (E) and three which are considered to be species of concern: *Calamagrostis expansa, Cyanea horrida*, and *Schiedea diffusa*.

Besides the Po`ouli, this area is known to support at least two other species of endangered forest bird, the `Ākohekohe and the Maui Parrotbill. Both of these species are Maui endemics, being restricted to upper elevation, rain forests of east Maui. Historic observations of the `Ākohekohe on Moloka`i indicate that it was once found in other areas of the Maui Nui island (includes Maui, Moloka`i, Lāna`i, and Kaho`olawe) as well as Maui (Perkins 1903; Bryan 1908). While the `Ākohekohe is locally common at elevations from 1,700-2,160 m (5,500-7,000 ft), the Maui Parrotbill is much more sparsely distributed and is found in lower abundance throughout its range (Perkins 1903; Scott *et al.* 1986). The Maui Parrotbill, like the`Ākohekohe, was formerly more widespread throughout the Maui Nui group, in drier, lowland habitats (Olson and James 1982). Recent population estimates for these species are approximately 3,800 for the `Ākohekohe and 500 for the Parrotbill (U.S. Fish and Wildlife Service 1984).

Three other endangered birds may still reside in this area, the Maui `Ākepa, the Maui Nukupu`u, and the Maui `O`o (*Moho* sp.). While the `Ākepa is still locally present on the Big Island of Hawai`i, Maui birds have been seldom encountered. Although they were reported as locally common in the 1890s, they have rarely been sighted in this century. If extant, this species is likely restricted to low numbers at upper elevation, remote locations. The most recent reports of sightings of this bird in the Hanawī area were in 1988. The Maui Nukupu`u is also most recently reported from this area. Reports of this bird as recent as 1988 have been made, but, like the Maui `Ākepa, the infrequent, and sometimes questionable, observations are cause for concern. The enigmatic bird of this area is the Maui `Ō`ō.

Both the N n (*Branta sandvicensis*) and the `Ua`u or Hawaiian Dark-rumped Petrel (*Pterodroma phaeopygia sandwichensis*) are resident in the mountainous areas of Haleakalā. While both of these birds may pass over the Hanawī area, there are no reports that either species uses the area for foraging or breeding. Although little reported, the Hawaiian hoary bat (*Lasiurus cinereus semotus*) is a likely resident of the Hanawī NAR. An occasional resident is the Hawaiian short-eared owl or Pueo (*Asio flammeus sandwichensis*). While not a federally listed species, it is

considered to be a species of concern by the USFWS.

3.4.3 Harmful, Non-native Species

A large number of harmful, non-native species are present within the known range of the Po`ouli. A number of these non-native organisms are likely responsible, to some degree, for the decline of the Po`ouli and other native forest birds, and the control of the more serious of these threats is essential for the successful recovery of the Po`ouli.

It has long been determined that wild pigs (*Sus scrofa*) have a major negative impact on Hawai`i's forest birds and to the Po`ouli in particular. The rooting of pigs destroys native vegetation and habitats and provides breeding habitat for introduced mosquitos, which carry avian malaria (*Plasmodium relictum*). Earlier accounts proposed an inverse relationship of Po`ouli numbers with the degree of pig activity in an area (Mountainspring *et al.* 1990). Although pig damage is not the only factor in the Po`ouli's decline, habitat destruction by pigs is recognized as a significant negative factor to native habitat and Hawaiian forest birds.

Numerous non-native mammalian predators are well established in the Hanawī area. Among these are feral house cats (*Felis catus*), the small Indian mongoose (*Herpestes auropunctatus*), and rats (*Rattus* spp.). While all of these are suspected to prey on forest birds opportunistically, it is predation by rats that is likely the most significant threat to the Po`ouli and other forest birds in these areas.

Mongooses have been known to take eggs, chicks, and adult birds when possible but are not present in Hanawī at the same density of rats. While cats are somewhat arboreal, they are not believed to be abundant in the forests of upper Hanawī (Maui Forest Bird Project Quarterly Reports and Field Summaries, 1995-1998). Until recently cats were not considered to pose a threat to unhatched eggs and nestlings of forest birds; however new evidence of a cat predating a Palila nest was captured on video by Paul Banko (BRD) (personal communication 1998). Both cats and mongooses are persistent, if only modest, predators of native forest birds, particularly those birds that commonly utilize understory habitats, such as the Po`ouli (Stone 1985; Scott *et al.* 1986).

Two species of rats, black or roof rats (*Rattus rattus*) and Polynesian rats (*Rattus exulans*), are known residents of Hawaiian forests. While Polynesian rats are believed to have arrived early on in the colonization of the islands (Tomich 1986), they are less common than black rats above 1,500 m (5,000 ft). Both species have been trapped in Hanawī NAR at and above that elevation. Black rats are largely nocturnal and arboreal and are believed to be active raiders of birds nests. They not only take eggs, but will also prey opportunistically on sleeping and brooding passerines, as evidenced by the recent predation of an adult brooding female small Kauai Thrush, or Puaiohi, (*Myadestes palmeri*) on the island of Kauai (T. Snetsinger, USGS/BRD, personal communication 1998). Its generalized foraging behavior, arboreal habit, and ubiquitous nature make the black rat

an important target for control.

In addition to directly preying on forest birds, rats may also compete with the Po`ouli and other native forest birds for food (Stone 1985). Although observed in the upper canopy, the Po`ouli is typically associated with dense understory vegetation where it forages for insects and snails. Rats are known to feed opportunistically on arthropods and/or snails, and in some cases arthropods may make up a majority of the diet (Baldwin *et al.* 1952; Tomich 1986; Stone 1985). The black rat has been documented to be a serious threat to Hawaiian tree snails in some instances (Hadfield 1986).

A number of alien bird species are widespread at lower elevations and have become more abundant at higher elevations where native birds are resident. Among these are Japanese White-eyes (*Zosterops japonicus*), Red-billed Leothrix (*Leiothrix lutea*), Japanese Bush-warblers (*Cettia diphone*), Melodious Laughing-thrush (*Garrulax canorus*) and Northern Cardinal (*Cardinalis cardinalis*). The Japanese White-eye, Bush-warbler and Red-billed Leiothrix are highly insectivorous and thus can directly compete with the Po`ouli and other native birds for food (Ralph 1978; Stone 1985). In addition, all of these non-native species carry diseases such as avian pox virus (*Poxvirus avium*) and avian malaria. While the malaria parasite requires an intermediate mosquito host, avian pox virus can be transmitted through physical contact. Lastly, birds such as the White-eye and Leothrix are felt to serve important roles in the dispersal of certain non-native plants, such as passion fruit (*Passiflora* spp.), helping some alien plants to spread and become established in areas where they do not presently occur (Stone 1985).

Mosquitos (*Culex*) are vectors of avian malaria, which is believed to have been one of the most destructive factors to affect the Hawaiian avifauna (Warner 1968; van Riper *et al.* 1982). The upper elevation limit of the malarial parasite or of the mosquito vector is likely one of the most destructive factors which limits the Po`ouli and other forest birds to their current high elevation distributions.

4 Environmental Consequences

4.1 Effects on the Physical Environment

No significant effect is expected on the physical environment.

4.2 Effects on the Social and Economic Environment

Aside from its importance as a watershed area, the Hanawī NAR and surrounding areas are not used for resource extraction. All of these upper elevation lands are zoned as protected conservation land and are not heavily used for recreation. There is no cultural Hawaiian use of the Hanawī or surrounding areas, and, except for management purposes, these areas are closed to

hunting or only rarely accessed for this purpose. The proposed recovery actions for the Po`ouli, both those directed at the species and those that are habitat directed, are not anticipated to have any negative impacts to the social or economic environment of the area.

4.2.1 Population and Local Community

No local communities occur in the project area. The proposed activities will not adversely affect the communities that are located within 300 m (1000 ft) elevation of the coast. The proposed activities will not occur in areas currently open to public use.

4.2.2 Employment and Local Economy

None of the alternatives would result in changes to agriculture, farming, the visitor industry or any other jobs currently contributing to the local economy.

4.2.3 Land Use

No changes in land use will occur under any of the alternatives.

4.2.4 Archaeological and Historic Resources

None of the above alternatives will result in negative impacts to archaeological or historical resources.

4.3 Effects on the Biological Environment

4.3.1 Native Vegetation Communities

Under all of the proposed alternatives, the natural communities where Po`ouli will be captured and/or released will remain under the management of the Natural Areas Reserve System (DLNR) or National Park Service. Under none of the alternatives will there be any prolonged or intensive impacts to the native vegetation at any of the capture or release sites. It is possible that project activities may increase the chances of non-native weeds being introduced into these areas. Incipient populations of such weeds should be watched for and eliminated as quickly as possible. Native vegetation communities should remain relatively intact.

4.3.2 Endangered and Threatened Species

All of the alternatives require that birds be captured with the use of mist nets. Mist nets are unselective in the species of bird captured. Given the relatively high density of other endangered passerines present in the project area (see section 3.4.2 above), there is a possibility that other

endangered species will be captured in the mist nets. Should other endangered species be captured, the birds will be banded, measured, and promptly released, in accordance with the banding protocols specified in Appendix D. All biologists involved in mist netting, handling, and banding of the endangered birds will possess all necessary State and Federal permits for the handling of these endangered species.

Precautions would be taken such that none of the alternatives would have detrimental effects on endangered plants found in the area.

All of the alternatives have the potential to result in death or injury of the endangered Po`ouli. Given the steady decline of these birds in the wild since their discovery in 1973, as well as the difficulty of moving and/or rearing wild, insectivorous passerines, none of the alternatives assures the continued existence of the Po`ouli. Except for Alternative 1, no time should be wasted once one of the alternatives is selected as the preferred action. It is not known how old any of the extant Po`ouli are at this time. It is very possible that any of these birds could die prior to or after being placed in captivity (under any of the alternatives) simply due to natural causes of mortality. The longer the preferred action is delayed, the more likely that no options will be available.

4.3.3 Perpetuation of Native Biological Diversity

All of the proposed alternatives are specifically designed to perpetuate the native bird diversity of the east Maui rainforest. However, given past trends, under the Current Management Alternative, the Po`ouli will almost certainly become extinct within the next few years. The other alternatives seek to arrest the current decline of the Po`ouli and begin to increase its numbers.

4.3.4 Control of Harmful Non-native Species

The control of harmful non-native species is an ongoing problem throughout the State of Hawai`i. At present, land managers are conducting feral ungulate and weed removal, along with predator control (rats, cats, and mongooses), within the three Po`ouli home ranges. In the event that field aviaries are established and used as outlined in the above alternatives, predator control activities would need to be intensified around the aviary(ies). If any of the alternatives result in net increases of wild Po`ouli, then rat and predator control activities will have to continue and be expanded to include more native habitat. Given the limitations and great expenditures of conventional control methods, more cost-effective and efficient methods of rat and predator control will need to be explored and implemented in the future.

4.4 Other Effects

4.4.1 Irreversible and Irretrievable Commitments of Resources

None of the alternatives would result in an irreversible and irretrievable commitment of resources by the USFWS or the State.

4.4.2 Cumulative Effects

Under the Current Management Actions - No Manipulation Alternative, it is almost certain that the Po`ouli will become extinct in the next few years. With or without the presence of the Po`ouli in the Hanawī NAR, management for other endangered forest birds and plants will still be conducted and efforts possibly increased.

The immediate objective of the other alternatives is to rapidly increase the number of Po`ouli with the ultimate goal of establishing multiple, healthy, viable populations of this species, allowing its removal from the list of endangered and threatened species under the Endangered Species Act of 1973, as amended.

As stated in section 4.3.4, population increases of the Po`ouli, either as a result of captive propagation and release or from successful nesting of wild birds, will almost certainly require increased predator control efforts. If adequate land management techniques can be developed that will eliminate or greatly reduce those factors negatively impacting the Po`ouli (*e.g.*, predation, disease, competition with non-natives), then it is almost certain that other native species, including other endangered species, would benefit from this approach.

4.5 Summary

A summary of the Effects of the Alternatives on the Physical, Social, Economic and Biological Environment is presented in Table 4-1.

Table 4-1. Summary of the Effects of the Alternatives						
AFFECTED RESOURCES	**ALTERNATIVE 1 CURRENT MANAGMENT**	**ALTERNATIVE 2 TRANSLOCATE AND RELEASE**	**ALTERNATIVE 3 HOLD IN FIELD AVIARY FOR PAIR FORMATION**	**ALTERNATIVE 4 HOLD LONG-TERM IN FIELD AVIARY FOR PROPAGATION**	**ALTERNATIVE 5 HOLD IN FIELD AVIARY/ TRANSFER TO CAPTIVITY**	**ALTERNATIVE 6 CAPTIVE PROPAGATION**
PHYSICAL ENVIRONMENT						
Climate and Soils	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
Hydrology and Water Resources	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
SOCIAL/ECONOMIC ENVIRONMENT						
Population and Local Community	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
	None/Status Quo	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
	None/Status Quo	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
	None/Status Quo	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**	**None/Status Quo**
BIOLOGICAL ENVIRONMENT						
Native Vegetation Communities	**None/Status Quo**	**Minimal with full recovery**	**Minimal with full recovery.**	**Minimal with full recovery.**	**Minimal with full recovery**	**Minimal with full recovery**

Table 4-1. Summary of the Effects of the Alternatives						
Endangered and Threatened (E/T) Species	**None/Status Quo**	**Possible negative effect through death/injury of Po`ouli and other native E/T forest birds during mist netting, etc.**	**Possible negative effect through death/injury of Po`ouli and other native E/T forest birds during mist netting, etc.**	**Possible negative effect through death/injury of Po`ouli and other native E/T forest birds during mist netting, etc.**	**Possible negative effect through death/injury of Po`ouli and other native E/T forest birds during mist netting, etc.**	**Possible negative effect through death/injury of Po`ouli and other native E/T forest birds during mist netting, etc.**
Native Biological Diversity	**None/Status Quo**	**Possible negative effect through death/injury of Po`ouli and other native forest birds during mist netting. Possible positive effect through expanded habitat restoration efforts and Po`ouli restoration.**	**Possible negative effect through death/injury of Po`ouli and other native forest birds during mist netting. Possible positive effect through expanded habitat restoration efforts and Po`ouli restoration**	**Possible negative effect through death/injury of Po`ouli and other native forest birds during mist netting. Possible positive effect through expanded habitat restoration efforts and Po`ouli restoration**	**Possible negative effect through death/injury of Po`ouli and other native forest birds during mist netting. Possible positive effect through expanded habitat restoration efforts and Po`ouli restoration**	**Temporary negative effect from removal of Po`ouli from wild and possible injury/death of Po`ouli and other native forest birds during mist netting. Possible future positive effect through expanded habitat restoration and Po`ouli restoration.**
Harmful Nonnative Species	**None/Status Quo**	**Positive effect through expanded management.**	**Positive effect through expanded management.**	**Positive effect through expanded management.**	**Positive effect through expanded management.**	**Positive effect through expanded management.**

5 SUMMARY OF SIGNIFICANCE CRITERIA

The proposed project is not expected to cause significant impacts to the environment, pursuant to the significance criteria established by the State of Hawai`i Environmental Council (Hawai`i Administrative Rules, Section 11-200-12) and discussed below; therefore, the determination is to issue a Finding of No Significant Impact.

The proposed actions do not involve an irrevocable commitment to loss or destruction of any natural or cultural resource. All actions proposed in this Draft Environmental Assessment (DEA) are anticipated to prevent the extinction of the Po`ouli (*Melamprosops phaeosoma*).

The proposed actions will not curtail the range of beneficial uses of the environment. All affected areas are in the Hanawī Natural Area Reserve and Haleakalā National Park, which are zoned Conservation, and the activities proposed are intended to enhance the site for endangered forest birds, native plants, and other wildlife.

The proposed actions will not conflict with the State's long-term environmental policies. The proposed actions will not conflict with the environmental policies set forth in the State Plan and Chapter 344, HRS, in that the proposed management actions will not damage sensitive natural resources nor emit excessive noise or contaminants.

The proposed actions will not substantially adversely affect the economic and social welfare of the community. The proposed activities utilize the most cost-effective cnservation strategies for the recovery of a critically endangered species.

The proposed actions will not substantially adversely affect the public health of the community. The proposed actions will not emit excessive noise or contaminants and will not have substantial adverse affects on public health.

The proposed actions will not involve substantial secondary impacts, such as population changes or effects on public facilities. The proposed actions will not affect any existing public recreational facilities and will not induce population growth in the area.

The proposed actions will not involve a substantial degradation of environmental quality. Utilizing the best management practices will minimize impacts to the environment during implementation of these proposed actions.

The proposed actions will not have cumulative impacts or imvolve a commitment for larger actions. The proposed actions will not have negative cumulative impacts or involve significant commitment for larger actions than those described.

The proposed actions will not adversely affect a rare, threatened, or endangered species, or its habitat. Actions described will be implemented in a manner avoiding harm to any endangered plants or other rare, threatened, or endangered species, and many of the activities may benefit endangered species and their habitat.

The proposed actions will not substantially affect air or water quality or ambient noise levels. Because of the scale of the project, it will not substantially affect air or water quality or ambient noise levels. The habitat management actions proposed will, in fact, improve the quality of the watershed.

The proposed project is not located in an environmentally sensitive area (e.g., flood plain, tsunami zone, and coastal zone). Although the site is located in a Conservation District, the proposed actions are in accordance with the zoning of the area as preservation lands.

The proposed actions will not substantially affect scenic vistas and view planes identified in county or State plans or studies. The project will not affect any of the listed sites or vistas for Maui.

The proposed project will not require substantial energy consumption. The affected area is not on a local power grid, and, with sources being battery or generator power, energy consumption will be minimal.

6 List of Preparers and Reviewers

Preparers

Dave Hopper, Fish and Wildlife Biologist, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i
Sharon Reilly, Department of Land and Natural Resources, Division of Forestry and Wildlife, Honolulu, Hawai`i
Karen Rosa, Assistant Field Supervisor for Endangered Species, U.S. Fish and Wildlife Service, Pacific Islands Fish and Wildlife Office, Honolulu, Hawai`i

Reviewers

U.S. Fish and Wildlife Service Reviewers

Phyllis Ha, Ecologist, Pacific Islands Ecoregion, Honolulu, Hawai`i
Robert Smith, Pacific Islands Manager, Pacific Islands Ecoregion, Honolulu, Hawai`i
Barbara Maxfield, Public Information Officer, Pacific Islands Ecoregion, Honolulu, Hawai`i

Hawai`i Department of Land and Natural Resources Reviewers

Michael Buck, Administrator, DOFAW, Honolulu, Hawai`i
Mark Collins, Maui Forest Bird Project Coordinator, CPSU, Olinda, Maui
Paul Conry, Wildlife Program Manager, DOFAW, Honolulu, Hawai`i
Fern Duvall, Wildlife Biologist, DOFAW, Wailuku, Maui
Bill Evanson, NARS Specialist, DOFAW, Wailuku, Maui
Betsy Gagné, NARS Program Manager, DOFAW, Honolulu, Hawai`i
Jim Kowalski, Maui Forest Bird Project Field Supervisor, CPSU, Olinda, Maui
Carol Terry, Wildlife Biologist, DOFAW, Honolulu, Hawai`i

Other Reviewers

Al Lieberman & Cyndi Kuehler, The Peregrine Fund
Thane Pratt, BRD, Volcano, HI
Tonnie Casey, Kamehameha Schools/B.P. Bishop Estate

7 List of Agencies, Organizations, and Persons Consulted

The Draft EA is being distributed to the following agencies, organizations, and interested individuals:

7.1 Federal Agencies

U.S. Department of Agriculture

Animal Damage Control, Honolulu
Earl Campbell, Denver Wildlife Research Unit, Hilo, Hawai`i
Natural Resources Conservation Service, Honolulu (Kenneth Kaneshiro, Acting State Conservationist)
U.S. Forest Service, Pacific Southwest Research Station, Institute of Pacific Islands Forestry, Honolulu
National Recources Conservation Service, Hanā Soil and Water Conservation District

U.S. Department of the Interior

Secretary of the Interior, Washington, D.C.
Fish and Wildlife Service
- Director, Washington, D.C.
- Regional Director, Portland, Oregon
- Associate Manager, Endangered Species, Portland, Oregon
- Assistant Regional Director-Ecological Services, Portland, Oregon
- Assistant Regional Director-North Pacific Coast and Pacific Islands Ecoregions, Portland, Oregon
- Pacific Islands Manager, Pacific Islands Ecoregion, Honolulu
- Field Supervisor, Division of Ecological Services, Honolulu
- Special Agent In Charge, Division of Law Enforcement, Honolulu

Geological Survey, Pacific Island Ecosystem Research Center, Honolulu
- Hawai`i Research Station, Volcano, Hawai`i
- Haleakalā Research Station, Haleakalā National Park
- Cameron Kepler, BRD, University of Georgia-Athens
- Michelle Reynolds, BRD, Volcano
- Tom Snetsinger, BRD, Kaua`i

National Park Service, Pacific Area, Honolulu
- Superintendent, Haleakalā National Park, Maui
- Resource Management Division, Haleakalā National Park, Maui
- Resource Management Specialist, Hawai`i Volcanoes National Park

Congressional Delegation

Senator Daniel K. Akaka
Senator Daniel K. Inouye
Representative Patsy T. Mink
Representative Neil Abercrombie

7.2 State Agencies

Governor Benjamin Cayetano
Office of State Planning, Hawai`i Coastal Zone Management Program (Rick Egged, Director)
Office of Environmental Quality Control (Gary Gill, Director)
Office of Hawaiian Affairs (Linda Colburn, Administrator; Martha Ross, Deputy Administrator)
Department of Agriculture (James Nakatani, Chairperson)
Department of Land and Natural Resources (Michael Wilson, Chairman)
- State Historic Preservation Office, Honolulu (Don Hibbard, Director)
- Division of Forestry and Wildlife (Michael Buck, Administrator)
- Division of Forestry and Wildlife, Maui District Manager (Wes Wong)
- NARS Commission

Department of Education
- Public Library System - Hāna and Kahului, Maui and the State Library

University of Hawai`i
- Environmental Center
- Hamilton Library
- Secretariat for Conservation Biology (Nancy Glover)

State Congressional Representatives

David Morihar, East Maui District

7.3 County Agencies

Mayor Linda Lingle
J. Kalani English, Hana District Representative, Maui County Council
Maui County Council
Maui County Board of Water Supply (David Craddick, Ellen Kraftsow)

7.4 Hawaiian Community Leaders

Hanna Springer
Michael Minn, Hāna, Maui
Dana Naone-Hall, Wailuku, Maui
Living Indigenous Forest Ecosystems, Wailuku, Maui (Mahealani Kaiaokamalie)

7.5 Private Conservation Organizations

Local Organizations

The B.P. Bishop Museum (Donald Duckworth, Director and Carla Kishinami)
Friends of Haleakalā National Park
Hawai`i Audubon Society
The Nature Conservancy of Hawai`i (Alan Holt, Kim Harris, Eric Nishibiyashi, Alenka Remec, Mark White)
The Peregrine Fund (Bill Burnham, Jeff Cilek, Al Lieberman, Cyndi Kuehler)
Sierra Club, Hawai`i Chapter
The Wildlife Society - Hawai`i Chapter

National and International Organizations

American Bird Conservancy
American Ornithologists Union
American Museum of Natural History
BirdLife (formerly known as the International Council for Bird Preservation)
International Union for the Conservation of Nature
National Audubon Society
RARE Center for Tropical Conservation
Smithsonian Institution
Society for Conservation Biology

7.6 Private Landowners and Other Interested Parties

Peter Baldwin, Haleakalā Ranch
Maki Dee Boersma, University of Washington
Tom Cade, Professor Emeritus of Cornell University
Anne Carter, Maui Forest Bird Project Volunteer
William Conway, Wildlife Conservation Society
Garrett Hew, East Maui Irrigation Company
Susie Ellis, Captive Breeding Specialist Group, IUCN
John Fitzpatrick, Cornell Lab of Ornithology

Kamehameha Schools/B.P. Bishop Estate
Randy Bartlett, Maui Land and Pine
Ian McFadden, Dept.of Conservation, New Zealand
Patrick Morris, DVM, San Diego Zoo
Simon Mowbray, Dept. of Conservation, New Zealand
Ian Newton, Institute of Terrestrial Ecology, UK
Bruce Rideout, DVM, San Diego Zoo
Alan Saunders, Dept. of Conservation, New Zealand
Ullie Seal, Captive Breeding Specialist Group, IUCN
Noel Snyder, Wildlife Preservation Trust International
Martin Vince, North Carolina Zoo
Jim Wiley, Grambling State University
Gerald Winegard, American Bird Conservancy
Dave Woodruff, UC San Diego

7.7 Recovery Teams and Working Groups

Avian Disease Recovery Working Group

Carter Atkinson, BRD
Becky Cann, UH Mānoa
Keven Flammer, NC State University
Renate Gassman-Duvall, DVM, Maui
Lee Goff, UH Mānoa
Don Jansen, DVM, San Diego Zoo
Cyndi Kuehler, TPF, Hawai`i
Greg Massey, DVM, DOFAW
Bob Nakamora, USDA
Glenn Olsen, BRD
Charles van Riper, BRD
Thierry Work, BRD

Captive Propagation Recovery Working Group

Kelly Brock, USDA
Don Bruning, WCS
Scott Derrickson, National Zoo
Peter Luscomb, Honolulu Zoo
Greg Massey, DVM, DOFAW
Thane Pratt, BRD
Chelle Plasse, Disney's Wild Animal Park
Peter Shannon, WCS

Hawai`i Forest Bird Recovery Team

Carter Atkinson, BRD
Tonnie Casey, KSBE
Paul Conry, DOFAW
Fern Duvall, DOFAW
Steve Fancy, NPS
Lenny Freed, UH Mānoa
Jon Giffin, DOFAW
Jack Jeffrey, USFWS
Al Lieberman, TPF
Thane Pratt, BRD
Tom Smith, San Francisco State University

Hawai`i Surrogate Forest Bird Working Group

Don Bruning, WCS
Scott Derrickson, National Zoo
John Ffinch, Philadelphia Zoo
John Groves, North Carolina Zoo
Peter Luscomb, Honolulu Zoo
Greg Massey, DVM, DOFAW
Patty McGill, Brookfield Zoo
Chelle Plasse, Disney's Wild Animal Park
Lee Schoen, Houston Zoo
Peter Shannon, WCS

Pacific Avifauna Recovery Coordinating Committee

Don Bruning, WCS
Sheila Conant, UH Mānoa
Scott Derrickson, National Zoo
John Engbring, USFWS
Andrew Engilis, Ducks Unlimited
Rob Fleischer, National Zoo
Jim Jacobi, BRD
Lloyd Kiff, TPF
Stuart Pimm, University of Tennessee
Michael Scott, BRD

Genetic Sexing Advisory Committee

George Amato, Wildlife Conservation Society
Oliver Ryder,
David Woodruff
Curt Benirske,
Robert Fleisher, National Zoo
Barrie Mellars, UDL
Ed de Kloet, Avian Biotech

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Summary of Po`ouli Sexing Results

Prepared by Sharon Reilly

In October 1997 Mark Collins, the Maui Forest Bird Project Coordinator and the DOFAW staff, Sharon Reilly and Dr. Fern Duvall, began exploring methods for determining the sexes of the three known Po`ouli. At the beginning of the FY'98 field season, the priority was to capture, band and gather bio-materials for sexing the known birds. Since there was concern about the effect of collecting blood on such a critically endangered species, the partnership had recommended using the non-invasive technique with feathers. The University Diagnostics Limited Laboratories was contacted upon the recommendation from Martin Vince the Associate Curator of Birds at the North Carolina Zoo, Dr. Christine Sheppard, Curator of Ornithology at the Wildlife Conservation Society and Dr. George Amato, Geneticist at the Wildlife Conservation Society.

The original intention was to test UDL's technique using feathers from a known sex museum specimen. The holotype at the Bishop Museum was dissected and sexed by Andy Engilis (Wilson Bulletin 108:4 pg. 607-619), but the Museum records still showed that the sex was indeterminate. Plans were being made to send feathers from holotype to confirm Andy's results and to determine if UDL's test was appropriate. The decision to send feathers to UDL was accelerated when, in January, one Po`o-uli was captured in the field. Feathers collected from this bird and HR2 bird (captured April 1997 by Dr. Paul Baker) were shipped to UDL for testing. Their results indicated these birds were both females. (The technique developed and patented by UDL which was used to determine the sexes of these and the third Po`ouli is described in Attachment I.)

At the urging of other partners to confirm UDL's results, the National Zoo's Genetics laboratory and Dr. Rebecca Cann's, University of Hawaii were surveyed on their ability to perform this task. Dr. Cann was in the developmental stages and was in need of funding whereas Dr. Fleischer had more experience with other Hawaiian honeycreepers and had an equipped lab with experienced technicians. In addition, the Smithsonian Lab was the designated depository of genetic material of Hawaiian Birds, including DNA extracted from the holotype. (The Bishop Museum was reluctant to send out feathers from the Holotype, if genetic material was already available). Since Dr. Cann was still interested in this particular project, she was selected to work on the genetics of avian disease comparing different techniques to assess exposure to the plasmodium parasite.

The National Zoo Genetics Lab conducted several tests using primers described in the available literature, and were unable to get any results using these primers. During this initial period of confirming UDL's results, the third Po`ouli (HR3) was captured and banded and had feathers collected. UDL tested these feathers; their results indicated that the HR3 bird was a male. Upon request UDL conducted a second test of all three birds and these results were again 1 male and 2 females. The National Zoo lab continued to use several different primers, including primers sent to them from UDL. The only results produced by the National Zoo Lab were for 2 of the 3 birds (HR1 Male, HR3 Male). The primers successfully used are unknown but they were not the ones provided by UDL. Unfortunately they were not able to extract enough genetic material from HR2 bird; no results were produced. Beth Slikas, a Postdoctoral

Fellow in the NZP Molecular Genetics conducted these tests due to her experience at extracting and multiplying (using PCR) ancient DNA. Beth expressed her concerns about these results because of contamination found in the control samples. Not knowing if the contamination effected these results, the sexing test was to be conducted again (on the 2 Po`ouli in which she was able to extract enough DNA) and additional tests on known sexed Honeycreepers (from DNA banked in the lab). As of this writing those results are not available.

Since the National Zoo was unable to confirm UDL's results, a third commercial lab, Avian Biotech International, that specialized in DNA sexing using feather was contacted. Their technique compares sequence differences between the Z and W (sex) chromosomes. This technique is dependent upon identifying the sequence differences of known sexed birds (of the same or closely related species). Therefore they were asked to sex known-sexed Apapane and to use those results to determine sexes of the Po`ouli. Once establishing this baseline data on Apapane, they used that difference for Po`ouli. Their results suggested that HR1 and HR3 were both males. However, as Mr. de Kloet stated in his letter (Attachment III), there were enough differences between Apapane and Po`ouli, that the species were not closely enough related to use this technique. According Avian Biotech, inaccuracy in this test would produce a natural default toward MALE.

Since neither the National Zoo Genetics Lab nor Avian Biotech were able to confidently produce results on Po`ouli, UDL was sent additional feathers of known sexed honeycreepers. They were able to accurately sex one apapane (Female) but were unable to complete their test of the other birds. Like Avian Biotech, UDL observed notable differences between Po`ouli and the other honeycreepers. In one the last communications with UDL, they said they were going to attempt another test of the known sexed honeycreepers however, there are no results as of this writing.

As a reminder to those who have concerns about the accuracy of UDL's results and who are reviewing this summary, the only lab that has been able to accurately, in their own estimation sex Po`ouli, has been UDL. The other labs have conceded that they have not been able to successfully accomplish this task. Since these researchers are professionals who have no vested interest in what the sexes of the Po`ouli are, we should be willing to trust their own professional opinion of their own work. A further reminder, each of these facilities have provided these services free of charge and have vested an enormous amount of personal time and energy in answering this vital question. It should be a professional courtesy to them that these inconsistencies between the labs should not be considered failures and in no way should they reflect negatively on any of the facilities that have assisted us in this manner. Recognizing that the sexes of the Po`ouli is a critical piece of information, we must use the best information we have at hand. Hopefully we will be able to resolve this issue as soon as these other results are made available.

Sharon E. Reilly
Wildlife Biologist
Division of Forestry and Wildlife
1151 Punchbowl Street Room 325
Tele: (808) 587-4188
FAX: (808) 587-0160
e-mail: wildlife@pixi.com or shareilly@aol.com

July 17, 1998

Attachment I

Excerpted from UDL's webpage, http://www.genelab.demon.co.uk/animal.htm) and also published in *International Zoo News* Vol. 44. No. 5 (1997). DNA AVIAN SEXING.

DNA Avian Sexing - the Latest Developments

Sexing of avian species not differentiated by plumage or specific sexual characteristics has long been a problem for aviculturists and zoos alike. A number of systems from cultured cell karyotyping to endoscopy of anaesthetised birds have been tried with varying degrees of success. University Diagnostics LTD (UDL) has developed a highly sensitive and accurate system based on DNA extracted from either feathers or blood. The technique was discovered by Richard Griffiths at Oxford University in response to a request to provide a captive-bred mate for the last Spix's Macaw living in the wild. The scientists concerned wanted to release a companion of the opposite sex to ensure that skills of survival in the wild were not lost but did not want the stress or danger of the capture that would be required for conventional sexing. The test uses the Polymerase Chain Reaction (PCR) methodology and patented primers to prepare millions of copies of the minute amount of sex-linked DNA present in feathers. This method provides sufficient DNA from a specific part of the avian sex chromosomes (W & Z) for sex analysis. This system analyses a highly conserved W-linked gene. At the same time a Z-linked gene is identified in the test and together they give the gender assignment of either male (termed ZZ with the absence of the female W gene) or female (WZ). The test only needs chest or head feathers not blood or wing/tail feathers. This test is not to be confused with the blood feather-based culture system, which is no longer considered reliable. Feathers should preferably be freshly plucked feathers as these reliably provide suitable DNA for analysis. The use of chest and head feathers is much less invasive than either blood or surgical sexing and far less traumatic. The potential harm or death associated with surgical sexing and anaesthesia is entirely eliminated. Birds such as penguins, however, are not well disposed to giving their feathers so a blood system has been developed which works just as well. Just a spot of blood is required because of the PCR method employed and this can be collected by claw clipping or foot pricking. The blood spots are simply collected on filter paper strips and dispatched in the same way as the feathers. Neither the feathers nor the blood samples require any form of special storage conditions and may be batched then posted by ordinary surface mail. Once collected and stored in the sterile sealable bags provided, temperature and humidity have no adverse affect on the samples. This makes the test especially useful for fieldwork when conditions often border on the primitive.

Attachment II
List of Bird Species sexed by UDL's technique.

African Grey Parrot
Amazon all spp
Aracari
Barbet
Bee-eater
Bird of Paradise
Bittern
Blackbird
Fairy Bluebird
Buzzard
Cacatua
Caique
Caracara
Catbird
Cockatiel
Cockatoo
Conure all spp
Corvines
Crakes
Cranes (Common, Japanese white-naped, Black-necked, Sarus, Demoiselle, Blue, Black-crowned, Grey crowned)
Cuckoo
Curassows
Curlew
Dove (Rock, Quail, Fruit)
Eagle (Golden, Tawny, Sea, Booted)
Egret
Flamingo (Greater, Chilean, Falcon)
Galah
Goshawk
Guan
Grouse
Harrier
Hawks (Harris, Red-tailed)
Heron
Honeyeater
Hornbill
Ibis (Sacred, Black-faced, Hermit, Scarlet, Glossy)
Jay
Kea
Kagu
Kestrel (Common, American)
Kingfisher
Kookaburra
Kite (Black, Red, Brahminy)
Lapwing
Lovebird
Lory
Lorikeet
Macaws all types
Magpies
Moorhen
Mousebird
Motmot
Mynah
Nestor
Nutcracker
Owls all types
Oystercatcher
Parrot all types
Parakeet
Partridge
Pelican
Pigeon (Pink, Bleeding Heart, Magnificent Ground, Blue-Crowned, Green Imperial)
Pionus
Pheasant
Plovers
Penguins (King, Humboldt, Gentoo, Rockhopper, Macaroni, Magellanic ,Blackfoot, Chinstrap)
Poicephalus
Rails
Roadrunner
Rosella
Seriemas
Shrike
Snowcock
Spoonbill (White, African,Roseate)
Starling
Stork (Marabou, Less Adjutant, White, Black, Milky Stork)
Swan
Tern
Thrushes
Tinamou
Tragopan
Trumpeter
Turaco
Toucan
Vulture (King, Turkey, Black, Griffon, Egyptian)
Warblers

July 17, 1998

APPENDIX B

Hawai`i Forest Bird Surrogate Group Protocols

Currently unavailable online
(email to request copies: wildlife@pixi.com)

APPENDIX C

Hawai`i Forest Bird Surrogate Project Summary

Currently unavailable online
(email to request copies: wildlife@pixi.com)

APPENDIX D

Mist Netting and Banding Protocols

INSTRUCTIONS FOR HANDLING BIRDS DURING MIST-NETTING AND BANDING

BEFORE HANDLING ANY BIRDS AT MIST NETS, GET INSTRUCTIONS FROM AN EXPERIENCED BANDER. BIRDS **CAN BE SEVERELY INJURED BECAUSE OF IMPROPER HANDLING. IT IS POSSIBLE TO SQUEEZE A BIRD TOO HARD OR TO BREAK A LEG OR WING. When holding a bird by its legs, always make sure** the hold is on the bird's femur, not on the tarso-metatarsus.

OPERATING THE MIST NETS:

Nets are opened each morning and closed each evening. For closing nets, wrap and tie at 1 meter intervals with colored flagging. Nets will remain attached to the poles overnight during banding operations. Nets will be removed from the poles when banding crews leave the study area overnight i.e., not remaining at the Base Camp) or for the weekend.

Nets, are checked every 30 minutes for birds during the day. However, it may be necessary to check them more during hot, misty, or windy periods. The nets will be closed during the day if (1) it is raining or there is a damp mist where moisture begins to bead on the net, (2) the wind increased to greater than 20 miles per hour, (3) there is extremely hot weather and banding personnel cannot remove birds soon enough to prevent captured birds from becoming hear stressed, or (4) any other situation where captured birds may be at risk. All nets will be closed at least one hour before sunset.

If birds become overheated or stressed when captured in nets, they can be given water to help relieve the stress. One obvious sign of stress is panting.

DANGERS TO WATCH OUT FOR WHEN REMOVING BIRDS FROM A NET:

When removing birds from a net, be aware of the bird's tongue. Some species (i.e., honeycreepers) have a "barb" near the back of the tongue which can get hooked on the mist net. If the net is caught in the bird's tongue or mouth, it may be necessary to cut the net. Scissors should be kept in the banding kit for this purpose.

If, for any reason the net is cut to remove a bird, check for any pieces of net that may still be on the bird. This is best done by blowing to lift the feathers in any areas when bits of nets may be present. IMPORTANT - CUTTING A NET TO REMOVE A BIRD IS A LAST RESORT EFFORT.

It is important to examine all birds captured for lesions before removing them from the net. Toward the end of summer, birds can shown pox lesions. Lesions will appear primarily on the legs or around the eye of an infected bird. If possible, wear rubber gloves to take the "pox" bird out of the net. It is very important to mark the net where the bird was captured (use color flagging) and close the net until the area is disinfect&d. A spray bottle of Environs should be kept with each banding kit for this purpose. Spray the area where the bird was captured and keep the net closed until the sprayed area is dry.

If lesions on an infected bird are discovered at the banding table, it is important to disinfect any instruments that came in contact with the bird and to clean your hands. Use alcohol for this purpose. Make sure the holding bags infected birds were carried in are not used again until they are cleaned.

BANDING THE BIRDS

While birds are held in bags waiting to be banded, tie the bag and bird on a bag-line at the banding station. Do not lay or set the bag with a bird down anywhere.

WASHING THE NETS

All nets brought in from the field should be washed and cleaned before reusing.

1. **Fill the sink with'ENVIRONS solution (1 tablespoon ENVIRONS to 1 gallon of water). Use enough solution to wash 3-4 nets per wash.**
2. **Soak the nets in the ENVIRONS solution for 10 minutes, then rinse then thoroughly with clean water an the adjacent sink.**
3. **using the same ENVIRONS solution, again soak the nets for an additional 10 minutes.**
4. **Rinse nets in clean water a second time, then hang outside to dry.**
5. **Discard the used ENVIRONS solution.**
6. **Prepare a new batch of ENVIRONS solution and repeat the process until all nets have been washed.**

WASHING BIRD HOLDING BAGS

All holding bags used to transport or hold birds in the field should be washed before reusing. Holding bags are routinely washed once per week. turn the bags inside out (seams will be on the inside) and wash with chlorox and detergent in a washing machine.

NOTE: The above information was extracted from protocol conglomerated by the U.S. Fish and Wildlife Service, National Biological Survey, 1849 C Street, N.W., ARLSQ 725, Washington, D.C. 20240 (202/208-6394)